Vol. XVII, No. 4
October, 1950

INDUSTRIAL QUALITY CONTROL

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Honoring A Distinguished Pioneer

QUALITY
through
Scientific
Methods

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-1

R QUALITY CONTROL

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Mr. Quality Control Engineer?

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Quality Control Computer

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Firm Name_____

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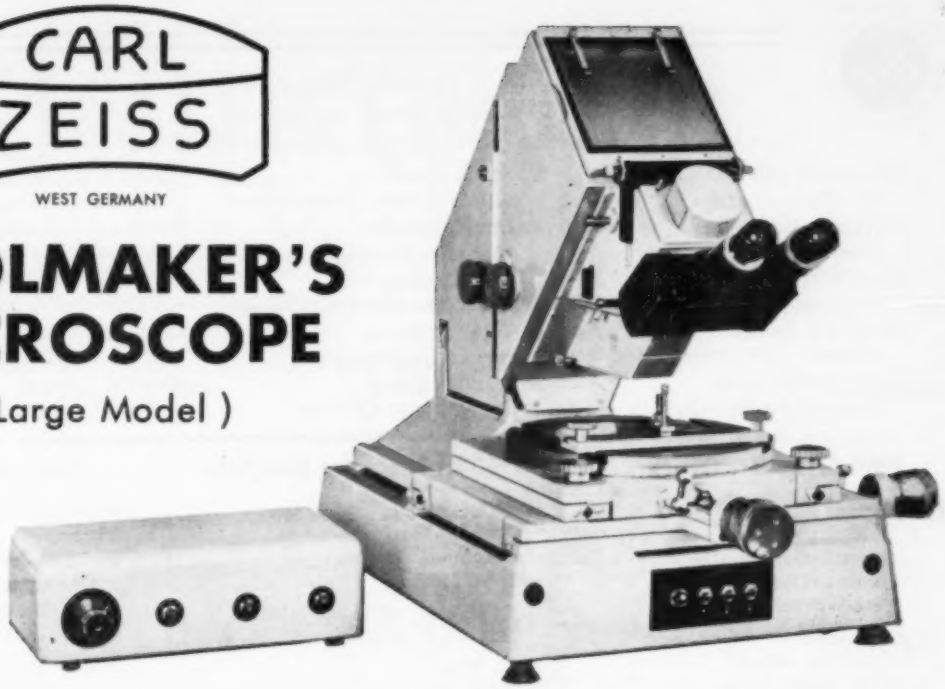

A decided advance over former instruments

Measuring range of 3x6″ permits extensive application

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This large toolmaker's microscope, made by Carl Zeiss, offers utmost ease, rapidity and great reliability of measurement.

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INDUSTRIAL QUALITY CONTROL

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Instrumental

QUALITY CONTROL

For Color

T. G. O'BRIEN,

IBM Federal Systems Division, Kingston, N.Y.

Problems Inherent in Visual Inspection

Controlling color by visual inspection has presented many unique problems in the painting, anodic coating, and plastic fields. The establishment of acceptance criteria in decorative pigmented finishes by visual comparison has always been a matter of personal opinion. There are generally two viewpoints in acceptance criteria by visual inspection—one that of the consumer and the other that of the supplier.

The consumer realizes in his own mind his need and requirements, but has no precise definition to convey his desire to the manufacturer or supplier. The supplier in turn has no concrete method of satisfying the consumer's needs, therefore usually works to some type of "standard" supplied by the consumer. Working to conventional types of standardization may result in either the consumer accepting substandard color match in order to maintain his production schedule, or extensive and expensive rework on the part of the supplier.

Many times designers unwittingly introduce variables in their blueprint notations which make it practically impossible to produce colored parts that will comply with the notations. An example of this would be when a designer calls out a Munsell notation to indicate the color desired and then requests that the finished part be covered with a clear lacquer for abrasion resistance. Although a painted part may have been a perfect match to the Munsell standard during the painting operation, the subsequent lacquer coating would change the specular gloss. Hence in the end result the finished product would appear completely different when compared visually to the standard, thus causing much confusion and possible rejection.

Misconcepts of Visual Tolerances

In an effort to set some type of tolerance the manufacturer habitually requests that the company buying the product establish a high and low chip indicating a range of color that will satisfy the needs of both the consumer and manufacturer. This as a rule adds to the confusion of color standardization because now no two inspectors can agree as to exactly what falls within the range of limits established.

This is understandable from the psychophysical aspect because of the Tristimulus inherent in color itself; namely hue, chroma, and value. It is very likely that an inspector comparing a painted part to the dark limit chip of a pearl gray color would accept parts containing a varying amount of blue or white reflection. Conversely an inspector comparing a painted part of the light limit chip would accept parts containing a varying amount of yellow or amber reflection. To the average person both parts would appear similar when compared to their respective chips. However, when the two production parts are placed adjacent to one another, a visual contrast takes place which will not be acceptable in final assembly. It is extremely difficult for a person having a trained eye to locate a color within a range if the particular color does not match one of the physical standards within the range, and therefore it is impractical to assume that the average inspector, or anyone for that matter, can compare to a range having only a dark and light limit.

ASQC LCS Codes 710:60;70:400

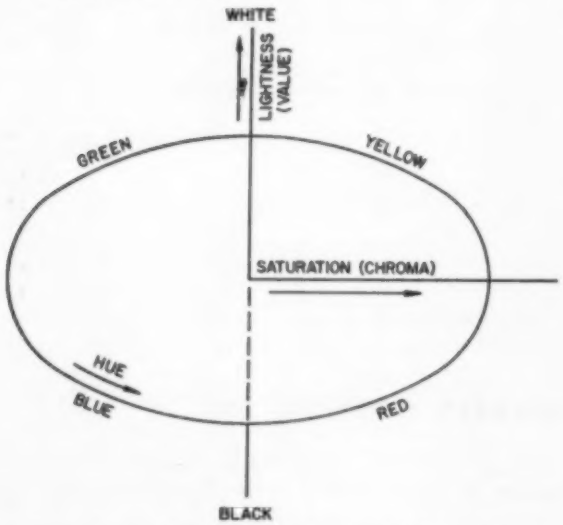

Figure 1—Psychological Aspect of the Achromatic and Chromatic Scales of Color Designation.

Application of Instrumental Measurements

The Kingston, N.Y., plant of the IBM Federal Systems Division had a unique problem in color matching—both textured and flat finishes. At times we had as many as thirty painting vendors supplying a particular color and type of finish. Parts from these various suppliers were eventually placed adjacent to one another in final assembly, revealing every type of color matching problem known. It became apparent that precise instrumental control would be necessary if any semblance of color control were to be maintained.

It was found during our development phase of color instrumentation for quality control that very few if any of the personnel within a given company realized or understood the basic philosophy of colorimetry. Many people, of course, are acquainted with the familiar spectral breakdown of color components in the visual spectrum obtained when white light is passed through a glass prism. Most, however, are not fully aware of the fact that reflected wavelengths of light can be measured, almost as readily as an inch can be measured by the use of graduations on a scale.

There are two basic classifications of color. One is Achromatic and the other is Chromatic. The achromatic scale defines the lightness range; i.e., white, black, and all the intermediate gray values. The chromatic scale includes the hue sensations and all the mixtures between them and the Achromatic range. The Achromatic range may be modified in

Figure 2—Instrumental Inspection of a Pre-shipment Standard on a Color Difference Meter.

only one direction, that is lighter or darker, whereas the chromatic scale can be modified in three directions. First, the hue can be changed, such as a yellow made greener or redder. Second, any color may be made more or less saturated which is a change in chroma. And third, any of the colors may be made grayer. Fig. 1 describes the psychological or visual aspect of the achromatic and chromatic scales.

A number of instruments have been developed which are capable of translating the qualitative psychological aspect into a quantitative physical measurement. One of these is the Gardner Automatic Color Difference Meter (Fig. 2). Fig. 3 describes the psychophysical aspect used to obtain the quantitative physical measurements.

Color differences may be measured by NBS* or ΔE units.† The formula currently used to calculate color difference is:

$$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$$

In order to simplify the mathematics of the above

*NBS—National Bureau of Standards.
†In accordance with popular usage the term "ΔE" will be used throughout this paper to denote color difference, although the correct vectorial term is "E". See Reference ASTM-D 1365-57T.

PART NO. _____ AQL. _____

P.O. _____ LOT NO. _____

TOL. ΔE=0.7 QTY. _____

1	2
TOL.	$(\Delta E)^2$
0.1	0.01
0.2	0.04
0.3	0.09
0.4	0.16
0.5	0.25
0.6	0.36
0.7	0.49
0.8	0.64
0.9	0.81
1.0	0.10

	L	a	b
STD.	16.1	−5.2	+.3
PART	16.5	−5.1	+.2
DIFF.	(.4)	(.1)	(.1)

$(\Delta L)^2$ 0.16
$(\Delta a)^2$ 0.01
$(\Delta b)^2$ 0.01
$(\Delta E)^2$ = (0.18) TOTAL

Figure 4—Instrumental Color Test—If Standard $(\Delta E)^2$ Is Equal to or Greater than the Measured $(\Delta E)^2$ Parts Are Acceptable

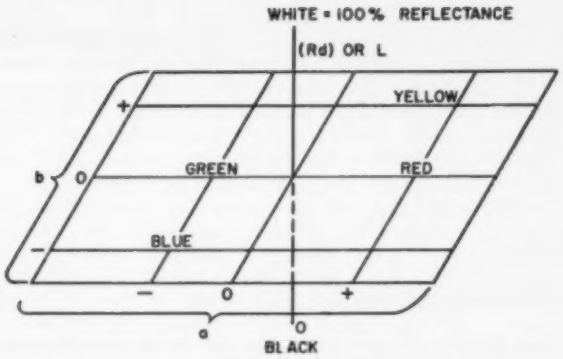

Figure 3—Three-Dimensional Color Scale Defining L, a and b.

formula, IBM has developed the following method of calculating ΔE so that an inspector can use instrumentation successfully. Although the material in this article is based on the color difference meter currently used at IBM Kingston, this information may be readily adapted to other types of instrumentation.

The ΔE calculation sheet (Fig. 4) is used in the following manner:

1. Tolerance specified by the manufacturer is placed in the space labeled "TOL".

2. Readings obtained from the manufacturer's standard are recorded in L, a, and b columns labeled "STD".

3. Readings taken from production sample are recorded in the L, a, and b columns labeled "PART".

4. Subtract differences between "STD" and "PART" and place results in column labeled "DIFF".

5. Square "DIFF" column L and place result on line labeled $(\Delta L)^2$.

6. Square "DIFF" column a and place result on line labeled $(\Delta a)^2$.

7. Square "DIFF" column b and place result on line labeled $(\Delta b)^2$.

8. Add $(\Delta L)^2$, $(\Delta a)^2$ and $(\Delta b)^2$ and record as TOTAL.

9. Locate manufacturer's tolerance in column 1, and read directly across to column 2. If the numerical reading of column 2 is equal to or greater than the numerical value of TOTAL, parts are within acceptable limits.

After completion of this instrumental color test, this sheet may be maintained as a record and the information can be readily used for correlation data.

Developing a Standardization Method

One of the most important elements in the use of instrumentation for color is an adequate method of standardization. Currently the following system is being used. The Industrial Design Department first chooses a color from either the Federal Specification TT-C-595, or the Munsell Book of Color, and then designates a code number to correspond. The notation number and code number are forwarded to the Tool and Gage Department of Quality Control for standardization. Wherever possible the Tool and Gage Department has the notation converted into ceramic

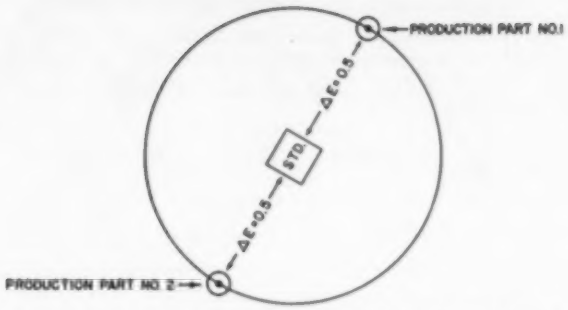

Figure 5—Total (ΔE) Between Production Parts Can Be Twice Measured (ΔE) of A Single Part.

standards. Aged ceramics are used because they are stable in both color and gloss. In addition if a ceramic becomes soiled, it can be readily cleaned with soap and water or non-toxic solvent.

Quality Control has been using ceramic standards for over a year and has not had to replace a single standard in the field or in our inspection departments during this time. Periodic check of all standards by instrumental control has revealed that no change of any kind has taken place in any of the standards currently in use. Realizing that the manufacturers of ceramics need a tolerance much the same as any other standards supplier, the Industrial Design Department furnishes a tolerance that may be used for procurement only. This tolerance may vary according to the need and complexity. All colors have been classified into decorative and nondecorative finishes. The type of classification determines the amount of tolerance allotted. The number of standards needed to control a given color is decided prior to placing

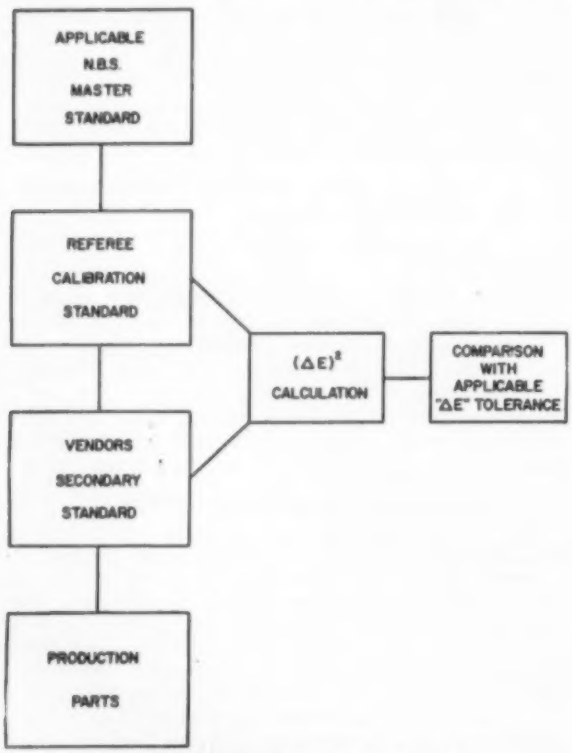

Figure 6—Flow Chart of Color Process Control.

the order for ceramics. This is done so that all standards can be made at one time, thus eliminating the problem of matching lot-to-lot in ceramics.

The tolerance specified in making standards would be interpreted as follows: In preparing blue decorative standards the manufacturer may vary a $\Delta E = 0.7$ from the notation supplied but must keep all the standards on the order within a $\Delta E = 0.3$ from one another. When the standards become available for production use, the blueprint will identify them with a code number as well as an applicable tolerance for production purposes. One thing which must be understood when calling out a ΔE tolerance on a blueprint is that the ΔE tolerance may double on a production run. For instance if the blueprint called out a $\Delta E = 0.5$, two production parts may vary as much as a $\Delta E = 1.0$ away from each other, as shown in Fig. 5.

A ΔE is the diagonal of a parallellepiped in a three-dimensional space; therefore it may be confused when trying to interpret a blueprint containing only a ΔE notation. Tolerances may be called out successfully by expressing high and low limits of the three vectors responsible for overall color difference, namely ΔL, Δa, and Δb. An alternate method is to vary the extracted square root of the sums, in which case the ΔE value can be readily controlled by calling out half of the variation required from part-to-part in actual production.

It has been found that the best reproducibility between instruments, (± 0.2 NBS Unit on each Scale) can be obtained by following exactly the sequence of standardizing, measuring and calibrating operations outlined in Fig. 6.

Step 1

The NBS values for R_d, a, and b are used to set the instrument.

Step 2

Color desired is provided in the form of a ceramic referee Calibration Standard. Readings are taken directly from the instrument and are recorded.

Step 3

Vendor secondary standard is held in the vendor's possession, and is assigned values directly from the NBS settings. These values are used only for setting instrument in production [Do not use these values for calculating $(\Delta E)^2$.]

Step 4

Set instrument with secondary standard. Place parts on instrument and read R_d, a, b, and L directly.

Step 5

Readings from production part are subtracted from values recorded for the Referee Calibration Standard to obtain (ΔL), (Δa) and (Δb).

Step 6

Compare calculated value of ΔE with applicable ΔE tolerance.

Pre-Production Approval by Instrumentation

Unfortunately not all vendors and suppliers have adequate instrumentation available. In such cases the supplier is requested to submit pre-production or pre-shipment samples for approval. If these samples fall within the allotted ΔE tolerance they are marked "approved" and are returned to the supplier as working standards. The vendor must then match these standards on all parts he supplies. If the sam-

ples are marginal or outside the allotted tolerance they are rejected and additional samples are requested. Wherever possible IBM will supply information and direction as to how the color may be corrected. This method has been successful in maintaining an overall tolerance of a $\Delta E = 1.0$ from more than 20 suppliers, who are applying textured gray wrinkle paints to production parts.

Painting problems can be minimized where several vendors are supplying the consumer, if the consumer controls the paint used by each vendor.

We develop each paint required and forward information as to where paint of this type and color can be purchased. Each time a new batch of paint is made by the designated paint supplier, a pre-shipment sample must be forwarded for approval. The paint manufacturer is allowed a tolerance of a $\Delta E = 0.5$ whenever the blueprint requires a $\Delta E = 1.0$, thus allowing the painter a $\Delta E = 0.5$ for process variation.

We realize that instrumentation can be used to the best advantage only when both the supplier and consumer have available similar instrumentation. With proper modifications, standardization and process controls can be established that may well be used in originating workable control criteria. Gone will be the days of personal opinion based only on visual inspection.

A $2,000,000,000 Quality Operation

WEBSTER ANDERSON,

Military Clothing and Textile Supply Agency,

Philadelphia, Pa.

The title, "a two billion dollar quality operation", is very misleading. The two billion is there alright, but not the quality, represented by the statistical quality control for which ASQC is recognized. After three years of effort, we are still a pioneer in a vast, new field. In spite of a few spectacular successes in applying SQC to clothing manufacturing, the industry as a whole is reluctant to embark on such a revolutionary voyage.

The Quality Cost Problem

Let us first try to understand why quality — positive quality within pre-established levels — is so important to us. The Agency, which I direct, supplies the clothing and related items of equipment to all the armed forces. "Well," one could say, "you have a captive market—why should you worry about quality?"

If I don't the chairman of my board, the Secretary of Defense, would find someone who would. Second, I have pride in my merchandise and interest in customer satisfaction. Thirdly, I operate on a revolving fund, a capital investment consisting of inventory and cash. As I sell inventory to my customers in the services, I receive cash in return. The sales price must be high enough to cover the cost of replacement, the cost of transporting goods, and all operational losses. These losses include items which reach the retail customer and have to be salvaged at that point for lack of quality. My sales price, therefore, is affected by the money I spend for quality in buying the item and the money I must spend to reimburse my customer when I fail to meet the quality level. Therefore, the acceptable quality level which I specify in my procurement must be nicely balanced. If I am to protect the integrity of my capital investment, I must have assurance that I attain this level. These reasons for my interest in quality are the same as those of any private businessman.

At my clothing agency, we face the same problem that every quality manager faces; namely, what should the quality level be and how should it be measured? We are leaders in the Free World in the military as well as in the political and economic sense. It is therefore essential that the appearance of our ambassadors in uniform, whether they be on a military staff in NATO or working side by side with a Korean soldier, reflect this position. To do this requires that the quality of design of our uniforms be at a sufficiently high level. The quality of design is accomplished by the research and engineering activities of each of the four services. On the other hand, the quality of conformance is of primary interest to my agency. My staff is responsible for preparing the quality assurance provisions for the items we buy. These provisions are incorporated in the specifications under which we procure.

In our sewing machine operations, we desire the uniformity of a controlled screw machine operation. We must, however, accept the impact of the human element. The quality of clothing is graded

ASQC LCS Code 350:20;40;70:422;423
Presented by Webster Anderson, Major General, USA, Executive Director, Military Clothing and Textile Supply Agency, Philadelphia, Pa., on the program of the Philadelphia section, ASQC, January, 1960.

or rated upon the amount of hand work involved. We can neither afford nor obtain a hand-tailored uniform for every man in the service. There aren't enough dollars in the treasury or tailors in industry. Consequently, we need the best quality obtainable at a reasonable price through a combination of machine and hand operations. A custom tailor would prefer that each of his $175.00 suits be distinctive, but we seek uniformity, not distinction.

Modern Quality Control Needed

We at the Military Clothing and Textile Supply Agency feel the answer lies, to a great extent, in quality control. The existence of an organization such as the American Society for Quality Control attests to the recognition and need of quality control by modern industry in this and other countries. However, experience indicates that the application of quality control to clothing manufacture may pose a more formidable challenge than that encountered in other industries.

The reasons are numerous. The basic problem is one of increasing the process capability of the industry. Inspection is not the answer, whether it be 100 percent or a sampling inspection. Perhaps the answer may be found in combining the use of quality control techniques with new methods of manufacture which would offer a more stable process capability. The prospects in the latter area, i.e., the introduction of new methods of manufacture, have not been encouraging in the clothing field. There have been few changes of a technological nature in the recent past. In fact, it appears that the technological level hasn't changed basically since the time the sewing machine was first introduced to the trade.

The other alternative is that of exploring all the quality control techniques that can be applied to an industry which relies largely on the human element. The systems of quality control that are applied to clothing manufacture must achieve economies similar to those realized in other industries in order to be accepted and retained in the clothing organization. We will do what we can in this area; however, we can't do the entire job alone. We need the help of the clothing industry itself and we also need the assistance of ASQC. It must be a mutual undertaking.

In recent years we have attempted in many ways to encourage a scientific quality control program in the clothing industry. We have attempted through every means at our disposal to sell this concept to the soft goods trade. We have authored and published "do it yourself" booklets on contractor testing and contractor examination, published blueprints for quality control for representative items, discussed quality control in meetings, conferences and seminars and prepared newspaper and magazine articles to sell our message. We have advised and assisted contractors in establishing inspection and quality control systems. In fact, we have even helped to train contractor personnel in inspection techniques and procedures to include the use of *MIL-STD-105A* and its successor *MIL-STD-105B, Sampling Procedures and Tables for Inspection by Attributes.*

Quality Control Policies and Plans at MC & TSA

One approach we have taken is to place the responsibility for quality control on the contractor himself, that is the manufacturer. This may sound like a very naive statement, but where else does it belong? Until very recently the contractor was not responsible for quality — we were! When we bought materials, *our* laboratory was responsible to see that they met our specifications. When he built clothing, *our* inspectors were responsible for his quality. Take components, for example. The contractor bought the cheapest he could get and hoped that they would be accepted by our technicians. Then three years ago came contractor testing; that is, we required the contractor to test his materials against our specifications and to submit to us the results of these tests. His material is accepted or rejected by our inspector based on his tests. By check-testing we assure the comparability of his laboratory with ours. This procedure has had the remarkable effect of reducing substandard material by 50 percent. It has demonstrated the value of our new policy and we look for similar results in the contractor visual examination program which we are now implementing.

I would like to demonstrate the faith we have in SQC. When we started the contractor testing program, we required laboratory tests and made check-tests on all lots of components offered regardless of whether the supplier had adequate quality control or not. We soon realized that this was an expensive operation and was not recognizing the value of a good existing SQC program. We therefore established what we call an Acceptable Suppliers List. Any supplier of garment findings and similar components such as buttons, zippers, thread, snap fasteners, rubber heels etc., who can demonstrate to us that he has an effective statistical quality control program operating in his plant is exempt from furnishing test results for each lot of items he furnishes to our contractors. We accept his Certificate of Compliance only, in lieu of such laboratory tests. This list has now been expanded to 33 categories of component items and includes some 150 approved listings for firms which have a recognized SQC program. This ASL has succeeded in expediting the acceptance of better quality supplies going into our end items.

The next step in this program of shifting to the contractor his contractual responsibilities for meeting quality is what we call Contractor Examination.

Formerly, the contractor in essence relied on end-item inspection by the government inspector to police the quality of his product. Yet we all know that quality can't be inspected into an item, it must be built in. To this end we have removed the government inspector from the production line. Formerly, the government inspector at a contractor's plant examined the finished items for the purpose of determining acceptability.

Then, a little more than a year ago, under our Contractor Inspection Program, we began to require contractors to perform the end-item examination of their product in addition to testing. Again they must furnish us with objective evidence that the supplies meet the contractual requirements. Government inspection has thus been converted from the function of mere acceptance inspection to that of quality assurance.

In other words, the contractor, who has always been held responsible for making the item according to specification requirements, is now responsible for testing and

examining it for conformance to these requirements. The government inspector's role is now that of assuring that the contractor has properly performed and documented his inspection. Present quality assurance techniques provides for government verification of a contractor's inspection on a lot-to-lot basis. Depending upon a contractor's quality history records, this frequency may be reduced to one out of every two lots or even one out of four. This verification involves a sampling inspection of the product coupled with a review of the contractor's testing and examination records for statistical comparability.

To accomplish this conversion from item inspection to system inspection, it has been necessary to engage in an intensive training program. This program has had two facets; first, training our own people; and second, training our contractors. We began with only a small nucleus of personnel trained in statistical quality control. However, we have now trained over 200 of our personnel in basic statistical quality control techniques. This training has been conducted primarily in a three week intensive course set up at the Quartermaster School at Fort Lee, Va. This has been supplemented by the Air Force School of Logistics courses at Wright-Patterson Air Force Base, Ohio, and at selected civilian universities. Advanced training is being provided for key personnel. Once we trained our own personnel, we then attempted to pass this knowledge on to our contractors and their personnel. This has included establishing quality control plans with necessary check points and instructing contractor personnel in sampling techniques for use at these check points.

These programs, however, have not resulted in complete success. It has been our belief that once a contractor established one real quality control check point, he would be bound to recognize what "in-process" quality control could do for him and for us. The Contractor Inspection Program required this one quality control point in the form of end-item inspection with the necessary records to make it effective. Despite all of these efforts, however, only 22 out of over 600 of our contractor's plants during this time have adopted a quality control system acceptable to the government.

Additional work is required of all of us. Insofar as our future programs are concerned, we plan to devote a major effort toward this job of selling quality control. Further, we are considering the possibility of requiring our contractors to have an adequate quality control system in order to be eligible for an Agency contract. This could be an extension beyond our present requirement that a contractor have the requisite physical facilities, personnel, and production know-how. These are the principal requirements for listing in our Qualified Manufacturers List, which is a prerequisite for bidding on clothing procurements.

ASQC Can Help

I would also like to recommend a program for ASQC. You are in an excellent position to help sell quality control and to participate in its growth through cooperation and direct participation with industry groups. Your organization offers the opportunity for all segments of industry to meet and work together on common ground in the interests of improving quality.

As an example of the results that can be achieved through cooperation of manufacturers and the American Society for Quality Control, I refer to the *Standard Procedure of Quality Evaluation for Woven Textiles.*

This procedure was developed and adopted by the Inter-Industry Committee of the National Association for Shirts, Pajamas and Sportswear and the Textile Division of the American Society for Quality Control. The procedure establishes a point system for evaluating defects in woven materials on an area basis as opposed to the old classification of defects used by textile mills which placed the results of specific manufacturing errors into such categories as slubs, mispicks, or reed-marks.

This new approach to the evaluation of woven fabrics recognizes the needs of the cutter or manufacturer rather than the technicalities of weaving. It seems a rather logical approach because, after all, who is the cloth being woven for, the mill or the tailor? It is a step toward modernizing this industry.

We have already experimented with this procedure and are quite enthusiastic about its possibilities. We propose to utilize it on a trial procurement in the near future.

Through cooperation and joint efforts in this and other areas, we can achieve our mutual goal of controlling the quality of manufacturers' products in the clothing, textile, and footwear industries.

Further, there is a vital need for quality control engineers in the clothing, textile and footwear industries. Quality control engineers are needed to assist in the production engineering phase of establishing a stable manufacturing process capable of measurement. Quality control engineers are needed to study and measure the processes, separate the controllable factors from the uncontrollable, and devise the means or procedures necessary to control these factors. I am convinced that the principal hope for further improvements in quality, without corresponding increases in cost of the items we buy, will be through the use of the tools of SQC.

It has been held by some that opportunities for fame and fortune in this country are decreasing. May I point out what I regard as a limitless opportunity for young men with vision, initiative and energy. There are over 1000 firms in the greater Philadelphia area in the industries associated with the Military Clothing and Textile Supply Agency. Of this number, some 25 have current contracts with the Agency. At the moment, not one of these 25 plants has a quality control system which is completely acceptable to the government. However, in each instance their end-item inspection system meets contractual requirements. From the records of the Philadelphia Section, ASQC, it is estimated that only four percent of the membership of this section represent industries of which I speak. On a national basis, out of over 12,000 members of your organization, only 325 or three percent, are members of the Textile Division. Here is an unparalleled opportunity for you as individuals and as an organization to further the goals of the American Society for Quality Control in spreading the gospel of scientific quality control. At the same time, you will be helping this nation to meet its Free World obligations through better use of its resources in men, materials, and money.

O C Curves for ChSP-1 Chain Sampling Plans

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Dodge[1] introduced the concept of chain sampling plans and gave examples of their use. In addition, he made certain suggestions as to which chain plans might be found most helpful in practical applications. However, it has been found that chain sampling plans are also useful in other instances. This article presents some operating characteristic curves for cases not presented by Dodge.

Description of Chain Plan ChSP-1

Chain sampling plan ChSP-1 utilizes attributes single sampling on a lot basis with a relatively small sample size, n, and an acceptance number, c, of zero. Its distinguishing feature is that a lot can also be accepted when one defective unit is observed in the sample, provided that no defective units have been observed in the samples from the i lots immediately preceding that lot from which the defective unit was drawn.

The conditions under which such plans can be used are as follows:

A. The cost or destructiveness of the testing is such that a relatively small sample size is necessary although other factors make a larger sample desirable.

B. The product to be inspected comprises a series of successive lots produced by a continuing process.

C. Normally, lots are expected to be of essentially the same quality (percent defective).

D. The consumer has faith in the integrity of the producer.

The OC curve of these plans is expressed by:

$$P_{acc} = P_{0,n}(p) + P_{1,n}(p)\,[P_{0,n}(p)]^i \quad (1)$$

where

$P_{0,n}(p)$ = probability of finding no defective units in a sample of n units from product of fraction defective p,

$P_{1,n}(p)$ = probability of finding one defective unit in such a sample,

i = number of immediately preceding lots with samples free from defective units required for the acceptance of a lot having one defective unit in its sample,

P_{acc} = proportion of lots expected to be accepted for a given product quality p.

ASQC LCS Codes 221;222:70:400

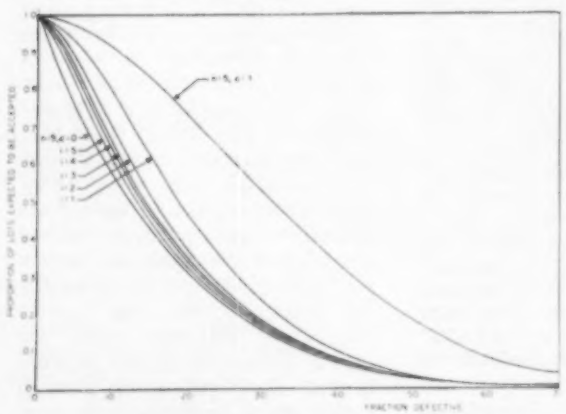

Figure 1—OC Curves for Chain Sampling Plans With n = 5

These plans differ from corresponding attributes single-sampling plans having sample size n and acceptance number zero in that p_{95} of the chain plan is substantially higher (up to four times as large) while p_{10} is only slightly (usually immeasurably) higher. (p_x is the fraction defective which results in the acceptance of x percent of the lots.) Because of this, chain sampling plans provide a means of maintaining a reasonably low p_{10} with a small sample size without the necessity of an extremely low p_{95}. In other words, a chain plan allows a steeper OC curve, and consequently a better resolution between acceptable and unacceptable product than can be obtained with an attributes single-sampling plan with the same sample size and acceptance number zero.

The larger i is, the closer the OC curve of the chain plan is to that of the single sampling plan with acceptance number zero. When $i = \infty$, the chain plan is a single plan with sample size n and acceptance number zero. When $i = 0$, the chain plan is a single plan with a sample size n and acceptance number 1.

Reference 1 shows OC curves of ChSP-1 plans with $n = 4, 5, 6$, and 10, and $i = 1, 2, 3, 4, 5$ and ∞. Reference 1 states the belief that values of $i \geq 3$ will be found most helpful in practical applications.* Actually, any chain sampling plan having the desired OC curve may be practical and, since $i = 1$ or 2 provides a greater increase in p_{95} than can be obtained with larger i's, $i = 1$ or 2 will often be useful, especially for larger n's. Chain sampling plans are equally valid with much larger sample sizes, and, in cases where an extremely high quality product is required, it is very desirable that those larger sample sizes be used. Figures 1 through 6 show OC curves for ChSP-1 plans with $n = 5$, 10, 20, 50, 75, and 100, and $i = 0$, 1, 2, 3, 4, 5, and ∞.

Example

A device having a limited lifespan and subject to intermittent, randomly occurring failures is being purchased. The probability of occurrence of such

*The author of reference 1 (Harold F. Dodge) in subsequent presentations has indicated that smaller values of i have definite advantages.

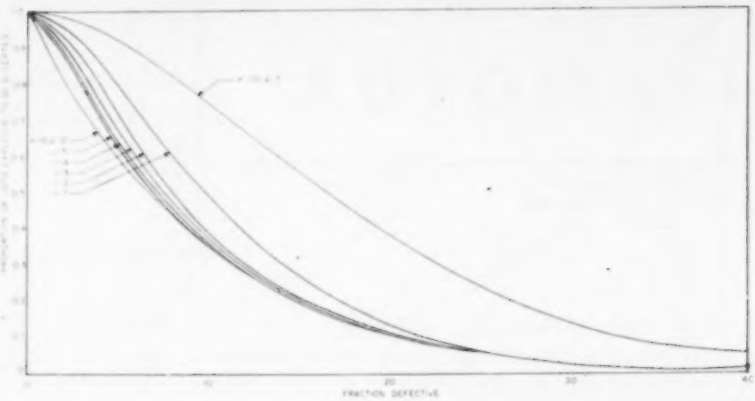

Figure 2—OC Curves for Chain Sampling Plans With n = 10

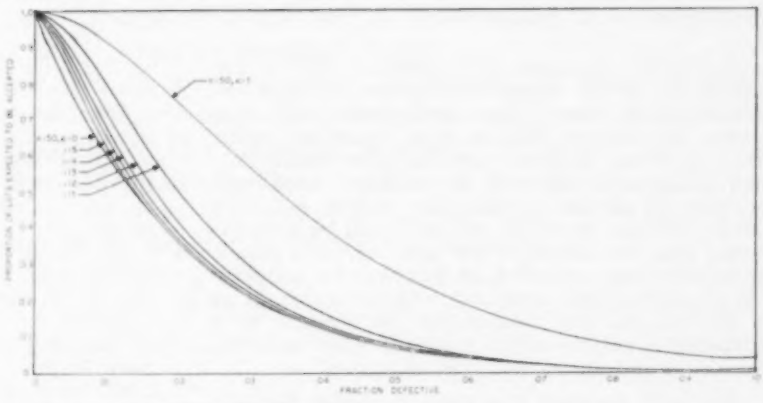

Figure 3—OC Curves for Chain Sampling Plans With n = 20

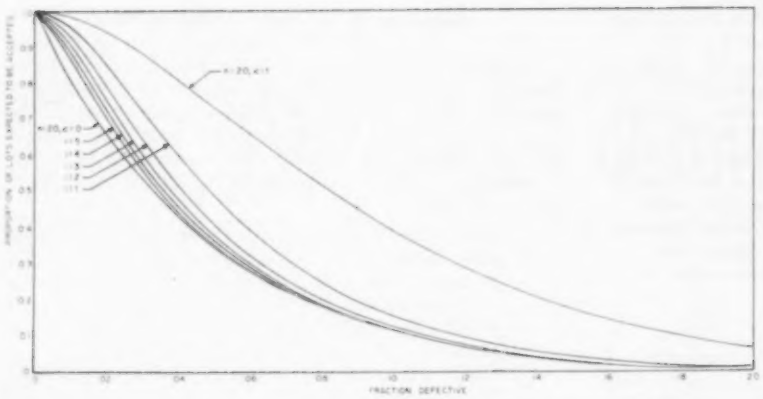

Figure 4—OC Curves for Chain Sampling Plans With n = 50

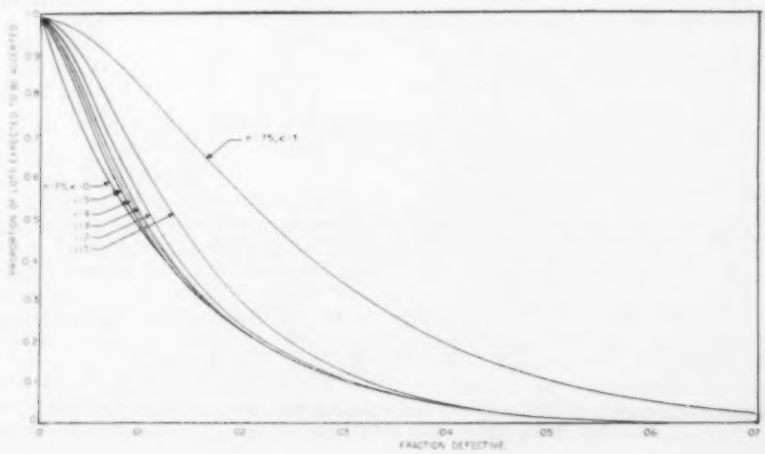

Figure 5—OC Curves for Chain Sampling Plans With n = 75

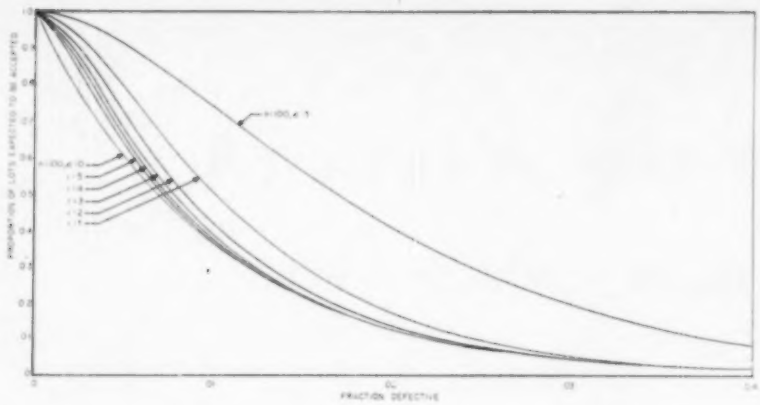

Figure 6—OC Curves for Chain Sampling Plans With n = 100

a failure is considered to be constant during the useful life of the device. The device performs instantaneously rather than continuously, and thus either succeeds or fails on each operation rather than operating for some period of time before failing. A sampling plan is to be applied to these units so that 95 percent of the units having a failure probability per operation of 0.0075 will be accepted while only ten percent of the units having a failure probability per operation of 0.11 will be accepted. To accomplish this, each unit will be considered as a lot and the first n operations of the unit as a "random" sample, and a sampling plan with $p_{95} = 0.0075$ and $p_{10} = 0.11$ will be applied.

No single sampling plan exactly satisfies the conditions $p_{95} = 0.0075$ and $p_{10} = 0.11$. However, plans with $c = 1$ and $n = 35$ (which satisfies $p_{10} = 0.11$) through $n = 47$ (which satisfies $P_{95} = 0.0075$) can be regarded as reasonably good approximations. Since the device under consideration has a limited lifespan, the plan having the smallest sample size, i.e. $n = 35$, $c = 1$, is the most satisfactory choice. However, 35 operations use too large a fraction of the useful life of the units. A single plan with a smaller sample size would not have a sufficiently steep OC curve. Double or multiple plans are not helpful since even though the average sample number might be reduced, many units might be subjected to an excessive number of operations.

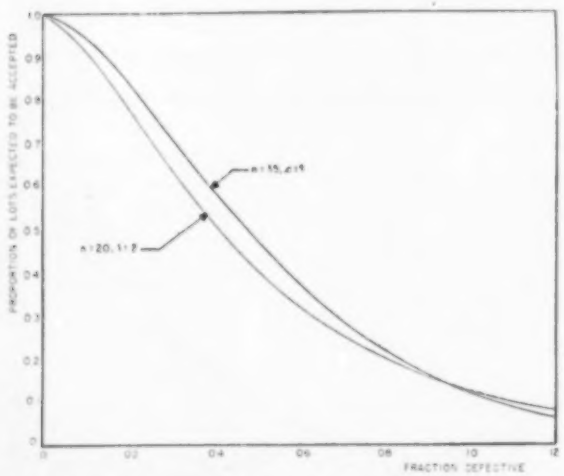

Figure 7—Comparison of OC Curves of a Single-Sampling Plan, and a Chain Plan Having Similar AQL's and LTPD's

Since consecutively produced units tend to be similar, a chain plan seems to be the logical type of plan to use. Referring to Fig. 3, it can be seen that the chain plan $n = 20$, $i = 2$, has the desired p_{95} and p_{10} and is therefore the proper chain plan to use.

The OC curves of these two plans ($n = 35$, $c = 1$ and $n = 20$, $i = 2$) are shown in Fig. 7. Although the curves are not identical, they are sufficiently close for the purpose at hand. Thus, in this case the use of a chain plan has reduced the sample size from 35 to 20. Since 20 operations could be tolerated, the chain plan was felt to be very satisfactory.

Selection of a Chain Sampling Plan

The plans whose OC curves are given in Figures 1 through 6 should cover most situations. In cases where none of the plans are suitable, it is relatively easy to select the desired plan, especially when OC curves for single-sampling plans with the desired sample size are available. The method of selecting a chain plan when the required p_{95} and p_{10} are given is as follows:

1. Select the single-sampling plan with an acceptance number of zero having the desired p_{10}. If p_{95} of this plan is less than the desired p_{95}, and increasing the acceptance number to one gives a p_{95} higher than desired, a suitable chain sampling plan probably can be found.
2. Using equation (1), compute the OC curves for chain plans (at least the upper ends of the curves) with various i's until the i is found which gives the p_{95} closest to the one desired. If the OC curves for the single plans are available, the probabilities in the right side of equation (1) can be determined from the curves and need not be calculated, since $P_{0,n}(p)$ is the ordinate at fraction defective, p, of the curve for acceptance number zero and $P_{1,n}(p)$ is the difference between ordinates of the curves for acceptance number one and acceptance number zero.
3. The plan has now been determined and the complete OC curve can be computed, if it has not already been done.

Reference

1. H. F. Dodge, "Chain Sampling Inspection Plan," *Industrial Quality Control*, Vol. XI, No. 4, pp. 10-13, January, 1955.

AUTOMATION AND QUALITY CONTROL

Introduction

Economic Background

THE United States is confronted at present with a serious economic problem. The demands for manufactured goods are rapidly increasing as the result of a combination of population growth, a desire for improved standards of living, foreign aid programs, and military equipment requirements. These demands are worth a brief examination to see why they cannot be circumvented and why they are causing economic stress.

Although population growth involves an obvious increase in demand for goods, it would seem as though such growth should be accompanied by a corresponding rise in the labor force. This is not occurring because, among other factors, the young are spending more time on the average in schools, and the old who are living in complete or partial retirement constitute an enlarging segment of the population. At present, about 8 percent of the population is 65 or older. By 1975, 9.5 percent of the population will be in this category.

The desire for improved standards of living must be respected in a free society since it represents a large part of what is meant by "the pursuit of happiness." This desire expresses itself in bargaining for higher wages and fewer hours of work. Clearly, such bargaining causes stress on the economy by creating new demands for consumer goods while simultaneously tending to reduce the labor force available to produce such goods.

Foreign aid programs should not be misconstrued as pure humanitarian gestures. They have become an essential part of an effort to acquire vital raw materials and to control the spread of Soviet influence. Yet such programs will make increasingly severe demands on our productive facilities.

Finally, the need for a large military establishment cannot be seriously challenged since there do not seem to be any acceptable alternatives. Yet, items of military equipment are becoming more and more elaborate with advanced technology, obsolescence rates are fantastically high, and suitable defensive systems to counter enemy aircraft, missiles, and submarines are becoming almost prohibitive in their size and complexity. The overall situation is tersely described by Department of Labor figures which estimate that a 100 percent increase of gross national product will be demanded by 1975 from a labor force which will have increased by only 28 percent.

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ASQC LCS Codes 740:60;70:400

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Need for Efficiency

Public welfare and national security would be seriously impaired by inadequate handling of the problem of increased demand for manufactured goods. In particular, the United States might be faced with runaway inflation followed by severe depression and then Soviet conquest or domination.

It is also apparent that any satisfactory solution of the problem will involve highly efficient utilization of resources. This will include improvement of yields from raw materials, reduction of man-hours per unit of production, and increase in volume of production per dollar of capital investment.

Actually, what is required is the acceleration of a trend which has existed since the industrial revolution. For example[1], the National Association of Manufacturers reports that between 1910 and 1955 man-hours per unit of production

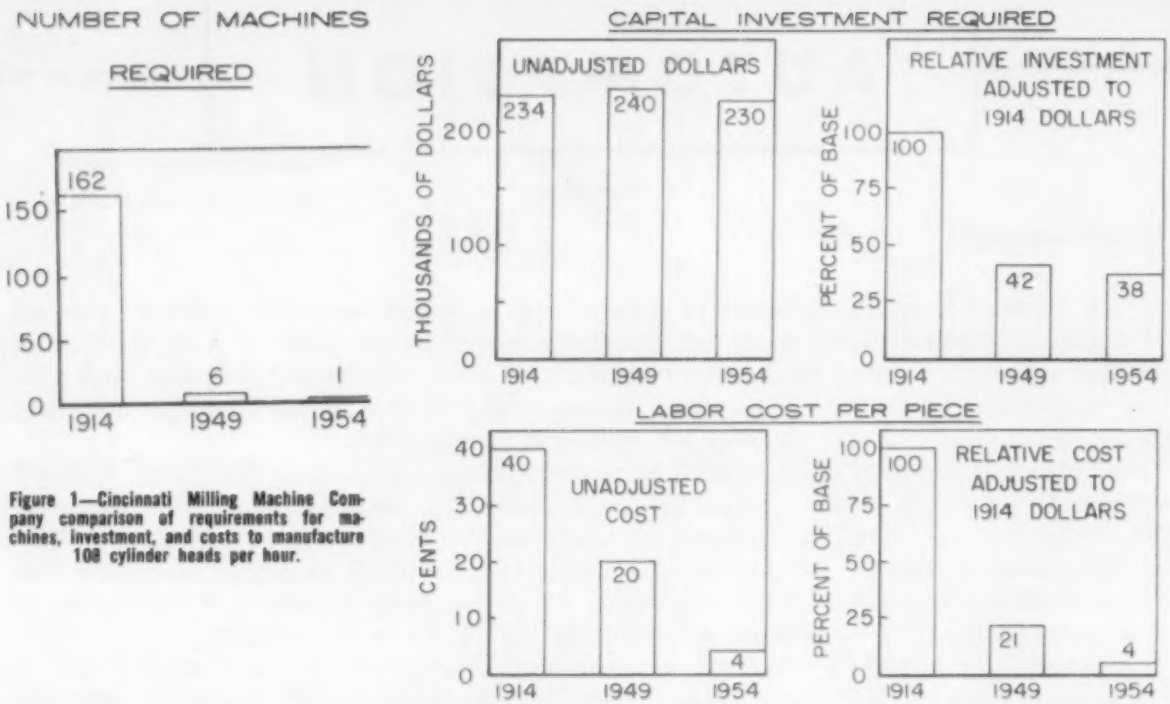

Figure 1—Cincinnati Milling Machine Company comparison of requirements for machines, investment, and costs to manufacture 108 cylinder heads per hour.

decreased by sixty percent. It is now necessary to progress much further in less time.

Effects and Potential of Automation

One key to such accelerated progress lies in the field of automatic process control combined with high-speed data handling, a field which we may designate briefly by the term "automation." With the proper development of automatic control, future processes will produce larger amounts of goods at much lower costs with a higher quality level and less waste. It should be noted here that automation is not in itself a technology. As Diebold states[2], "automation is a philosophy of production rather than a particular technology of control devices." The whole problem of production is approached anew — even the product itself is reappraised in terms of its function and the functions of the machines that handle it.

The results of automation can be dramatic. Figure 1 presents some data on the manufacture of cylinder heads by the Cincinnati Milling Machine Co. The number of machines required is reduced from 162 in 1914 to only 1 in 1954. The raw figures indicate that for about the same dollar costs of capital investment, and for the same level of production of an equivalent item, unit labor costs were reduced by 50 percent between 1914 and 1949 and an astounding additional 40 percent between 1949 and 1954. Parenthetically, we may infer much improvement in the quality and precision of the items produced. When costs are adjusted to reflect the changing value of the dollar, the figures show even more spectacular gains. Compared with 1914, by 1949 there was a 79 percent decrease in unit costs with a 58 percent decrease in capital investment. Again, compared with 1914, in 1954 there was a 96 percent reduction in unit cost with a 62 percent decrease in capital investment.

Another form of conservation of manpower is indicated in Fig. 2 which is derived from statistics of the Ford Motor Co.[1] Disabling injuries were reduced by 81 percent and lost days of work by 67 percent during a three-year period from 1947 to 1950 after the introduction of advanced automatic equipment.

With respect to the future of automation, Dr. Simon Ramo states[3], "Technologically, we are at the point where great strides can be made. The military situation in the world is sparking the program and, in effect, is sponsoring and financing the development of techniques that will have application to non-military systems as well . . . There is a demand to get on with the job of producing new automation devices and automation systems."

In terms of challenge, the field of automation offers excellent opportunities. There are many unsolved industrial processing problems. The degree of progress which automation requires demands scientific insight and creative thinking in contrast to the "cookbook" approach generally utilized. Many attempts at process control have failed because the process itself was not properly analyzed as a prelude to the installation of hardware intended to "control" it. Dr. Dean Wooldridge has made a comment about the synthesis of military systems which is equally applicable to non-military ones[3]: "The black-box approach to . . . systems is the improper approach and does not work . . . The proper approach which *does* work, is to assign systems responsibility . . . to a single group of competent, versatile scientists and engineers."

Discussion

Scope of Automation

Industrial automation can be conveniently examined in terms of three basic activities:

1. Application of automatic controls to individual unit processes
2. Synthesis of automatically controlled systems of unit proc-

esses to meet established process requirements

3. Regulation or adjustment of automatic systems to conform with schedules or with altered process requirements

A unit process is to be construed here as one of a system of elementary physical operations used for the conversion, manufacture, distribution, or transportation of commodities. For example, petroleum refining can be treated as a combination of heating, cracking, and fractionating operations. The manufacture of a cylinder head is a sequence of grinding, turning, boring, tapping, and polishing operations. The shipment of freight by rail involves loading, routing, temporary storage, and unloading as constituent unit processes.

Within the framework of this general definition, the phrase "unit process" has various usages. It can refer actually to a class of particular operations with common characteristics, e.g. drying of pulverized materials. It can also refer to a specific operation which is meaningful only in terms of some larger process, e.g. the alignment of billets in a steel sheet rolling mill. Moreover, a given process can usually be analyzed in several different ways as a combination of constituent operations which are then called unit processes. Not all of these analyses are equally useful either for understanding the process or for controlling it.

The activities of (1), (2), and (3) are best understood simply as part of the evolution of techniques for dealing with the primary aim of the Industrial Revolution, that is, the efficient harnessing of sources of power for the production of commodities with a minimum of manual labor.

What exists today as a result of this evolution is a complex and heterogeneous situation. Certain industries, such as steel, have just begun to examine their traditional methods of production for possibilities of automation. Other industries, such as petroleum refining, already represent such a high degree of automation that direct labor has been practically eliminated. In general, the progress of automation within an industry tends to follow the order of (1), (2), and (3). At first, individual unit processes are instrumented in the hope of obtaining information useful for making manual adjustments. As knowledge of control requirements on a process grows, it is usually possible to make adjustments automatically, if necessary, by some kind of closed-loop operation. Effective control of the unit processes in turn supports efforts to obtain automatic flow of objects or materials from one unit process to another, thus giving rise to such things as automatic production lines. Finally, if these systems of unit processes are accompanied by an efficient method of adjustment or regulation to meet changing demands by the business operations which they serve, then automation is complete.

Significance of the Unit Process

In order to develop some perspective on the role of the unit process in the context of automatic process control, it is informative to consider the following statements. Professor Brown of the University of Michigan states [4]:

> "In general, there are two different approaches to the study of industrial processing. Each particular industry, such as the alcohol, petroleum, plastic, copper, or steel industry, including its characteristic operations, may be studied as a unit; or the different operations common to many industrial processes may be classified, each according to its function without regard to the industry using it, and each operation studied as a unit operation . . .
>
> "As industrial processes have become more varied and technical, the fields open to the engineer have widened and it has become

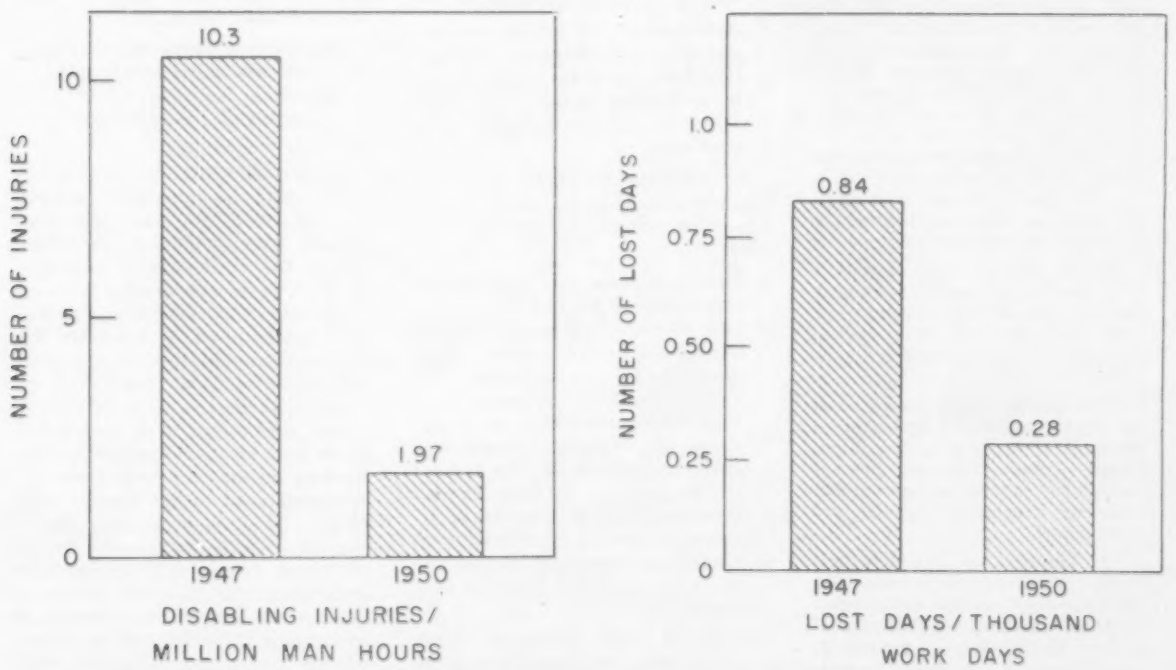

Figure 2 — Ford Motor Company accident statistics before and after introduction of advanced automatic equipment.

increasingly difficult, if not impossible, to cover the various industries in an adequate manner . . . By studying the unit operations themselves and their functions, the engineer is trained to recognize these functions in new industrial processes; and by applying his knowledge and skill in the corresponding unit operations he is able to design, construct, and operate a plant for a new process with almost as much confidence as for a proved process. . . . "

The late Professor Campbell of M.I.T. discusses the needs of process control from a feeling of unhappiness with the conditions he found as a consultant to industry[5].

" . . . I am still dissatisfied with much of the work being done in the process control field because it is not quantitative, and it is not founded upon a sound theoretical basis. The fields of instrumentation and process control are little more than an empirical art. They are not a science.

"I believe the history of the development of the field tells us why. The instrumentation field grew from rather crude beginnings around 1900 along empirical lines. The needs of industry dictated design. Research was at best what should be called expedient development or invention . . . With few exceptions, the instrumentation and process control field has never been approached with a view toward putting the concepts of measurement, communication, manipulation, and process dynamic response upon a sound mathematical foundation. Likewise, the approach to plant design has left much to be desired. The designs were conceived along static or steady-state lines . . . (Designers) do not look upon the plant as being an inherently dynamic working system.

"Even today many engineers who build industrial automatic controls are so busy putting out small fires that they fail to recognize the over-all generalized concepts of a plant.

"The concept of processing must be distinguished from process equipment. Processing is a functional action, whereas process equipment constitutes the vehicle whereby processing can be accomplished.

"... The manner in which individual processes interconnect, one with another and one acting upon another, gives an organizational pattern to the over-all process. It establishes a process *system*, which is composed of several *unit* processes."

Economic and Technical Problems of Automation

Work in the field of automation has many pitfalls. The economic problems can be formulated in terms of the following considerations:

1. A systematic program of automation in many industries might involve the rapid obsolescence of large amounts of existing equipment. The losses incurred in discarding this equipment would have to be compared with the increased profits resulting from the adoption of the new equipment.
2. Extensive automation of operations in a company would require retraining and reassignment of many of the company's personnel. Consequently, there would be a transitional period during which the new system would not be functioning to its maximum advantage. The difficulties during this period would be aggravated by the need for debugging the newly installed equipment.
3. There would be a danger in developing highly automated equipment so specialized as to freeze the operating procedures or product line of its users. Companies associated with a rapidly changing branch of technology could easily be hamstrung by such equipment.
4. Automation for companies engaged in non-repetitive or custom work could be justified only to a limited extent, e.g. only with respect to selected unit processes.

In addition to these economic considerations, there are difficulties of an essentially technical nature.

5. Unit processes are usually not genuinely improved by a routine or slap-dash application of instruments and control gadgets. The process variables must first be isolated and studied to find those variables or functions of variables which are truly important for the control of the process. It may be determined, in fact, that the proper regulation of a process as an open-loop operation makes the use of closed-loop controls unnecessary.
6. Certain unit processes have never been sufficiently studied to build up a general fund of knowledge on the basis of which special investigations can be efficiently undertaken. These include drying, mixing, coating, and continuous inspection of surfaces.
7. Automatic systems are frequently designed simply by using machines to copy manual functions in the original process. Such practices tend to result in Rube Goldberg contraptions. The rational design of an automatic system requires synthesis of a system satisfying the process requirements from unit processes which are chosen for simplicity, ease of control, and ease of transfer from one unit process to another.
8. Automatic systems are sometimes designed without sufficient attention to the problem of running them as an integrated part of the operation of an industrial organization. What is overlooked in such cases is an operational analysis of the company with the aim of determining complete process requirements.

The following section presents an example of a preliminary kind of operational analysis that might be used as a first step in exploring the process requirements of a manufacturing facility.

Analysis of an Automated Factory[6,7]

In an automatic factory there are five basic functions:

1. Essential working operations
2. Inspection or measurement
3. Materials handling
4. Assembly and packaging
5. Central control

Figure 3 illustrates these requirements in schematic outline. All operations are centrally controlled from a master controller under the direction of management. The master controller uses internally and externally generated information to establish the internal schedules and thereafter programs the local controllers for storage, individual production lines, assembly, and packaging. Each local controller regulates the local operation and feeds back operational data to the master controller. To date, in existing applications of this type, only simple variables have been successfully controlled. Much more work is needed on simplified methods of measuring variables and on methods of measuring essential characteristics not now measured. Assembly of simple devices can now

be accomplished, but much remains to be done for miniature and precision assemblies. At present, progress here has generally been limited to automatic feed mechanisms. One significant gain in recent times, however, has been the development of automatic circuit production through the use of printed circuits.

Central control and local control are exercised with the aid of both general and special purpose computers. These computers will tend to grow in both capacity and efficiency. Inspection or measurement referred to as the second basic function, is growing in scope and importance.

The New Inspection

The following excerpts from a recent article give the broad outlines of the development.[8]

> "Plant operating managers today are grappling with quality demands that force them to excel standards that were way out of reach just a few years ago . . . The ultimate result of the new inspection (function) is that it will be absorbed in process control in one continuous loop operation (thus) losing its traditional separate status . . .
>
> "The mechanical industries are beginning to narrow the gap between antiquated inspection methods and the new, integrated inspection systems of the (continuous) process industries (by) . . . engineering the measurement system along with the production process (including) . . . developing a wide range of non-destructive methods of testing . . . (and) measuring things that operating men only a few years ago didn't know existed. There is no equipment commercially available for many specialized inspection jobs . . . For each new variable that's identified, new instruments must be devised to measure or control the variable in production . . . "

Implications for Quality Control

Brief Review

Now, let us review the implications of all of the foregoing in terms of the Quality function. First of all, we list Feigenbaum's classification [9] of the existing philosophies of quality control in the order of their historical appearance:

1. Inspection Quality Control. This has been presumably practiced in some form as long as man has made things. This is basically a sorting operation which separates good from bad material, frequently by 100 percent measurement of all finished product. In some cases, statistical sampling and in-process inspection are used to improve efficiency of these operations, but they do not alter its basic character.
2. Statistical Quality Control. As practiced today, this dates from Shewhart's first paper in 1923. This approach is simply the application of statistical methodology to the problems of processing and manufacturing, as well as to inspection.
3. Reliability Quality Control. This area came into being, roughly,

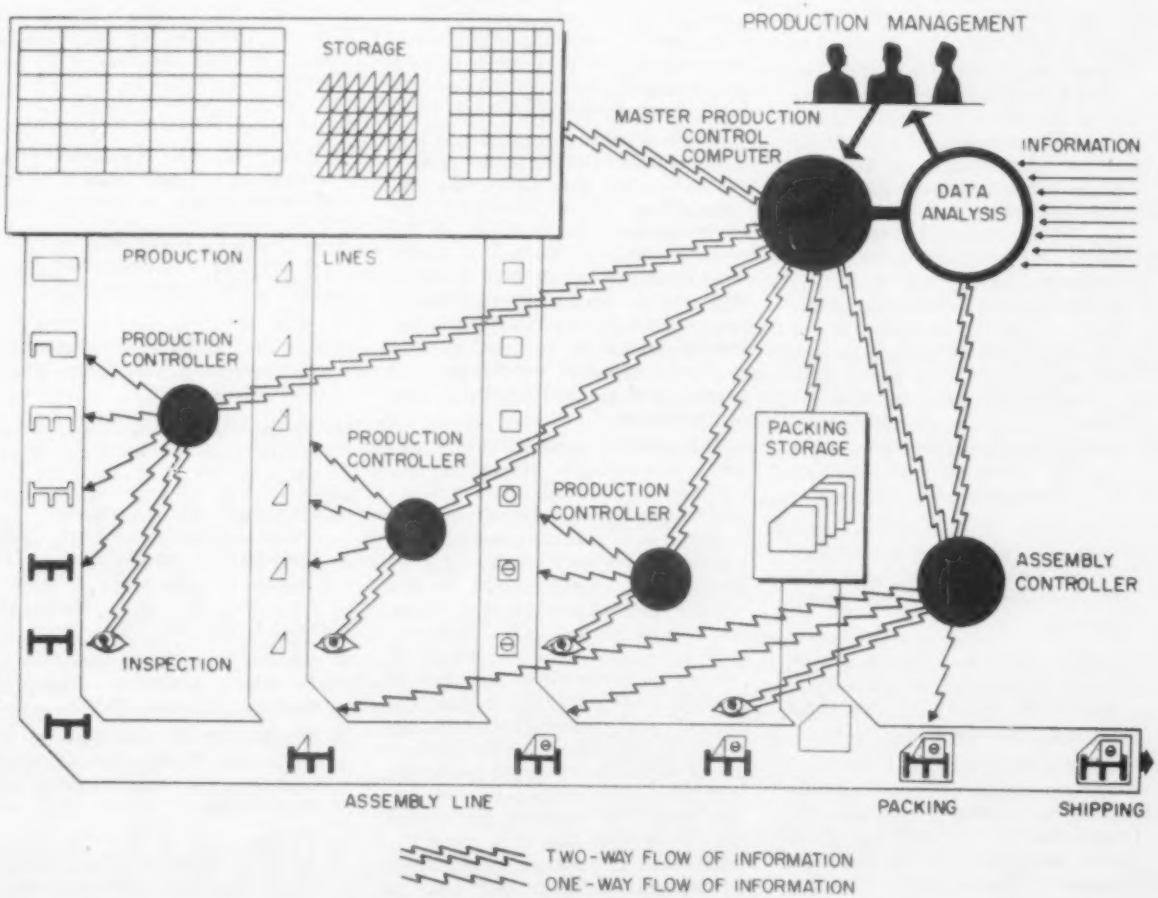

Figure 3 — Schematic of Automatic Factory.

during World War II. Here, the primary interest lies in measures and techniques for evaluating and predicting equipment performance over the life or use cycle.

4. Total Quality Control. Because of the restricted range of operations usually encompassed by the earlier forms of quality control, there has emerged during the last ten years a broader outline of responsibility for the quality function. This responsibility requires association between quality personnel and all of the other functions in an organization responsible for the successful design, manufacture and application of a product.

The discussion developed in the first two parts of this article have included a functional description of total quality control from the standpoint of industrial organization, economics, and systems engineering. In somewhat unfamiliar language we have been considering the following basic quality functions.

Again following Feigenbaum,[9] we distinguish:

1. New Design Control. This includes preproduction services to Engineering and Manufacturing to plan for products which will be as defect-free as possible prior to actual production. This can include product and process capability studies, tolerance review and analysis, pilot plant experimentation and value analysis. Inspection and test planning require consideration of classifications of defects, points of inspection and procedural techniques. Finally, test and inspection equipment should be designed and engineered for the specific measurement situation to be encountered.

2. Incoming Materials Control. This includes inspection of material, evaluation of part and vendor performance, and vendor contact.

3. Product Control. This is simply the aggregate of in-plant test, inspection and control functions during production.

4. Special Studies. This can include analyses of areas contributing to quality problems with the vendor, through the plant and its operations to the customer point of use.

The preceding functions are carried out by functional groups which we ordinarily consider as Quality Control Engineering, Inspection and Test. Very briefly, Quality Control Engineering commences quality planning as early as possible, preferably in the preproduction phases. Inspection and Test operate so as to control incoming, in-process and outgoing quality, and to serve as a source of data for the various quality analyses. This can be an extremely efficient feedback loop. The objectives of this feedback are to provide assurance of product quality and to assist in achieving optimum quality costs for the products.

Initial Impact of Automation

The first and most obvious impact of automation will be on the functions of Inspection and Test. The end result may well be a virtual elimination of in-process inspection and testing through automatic equipment engineered into the process to perform these functions as part of the control system. Thus, we should find Inspection and Test as we have come to know it replaced by an engineering function which will be closely related to present day test equipment and instrumentation engineering.

Another consequence of importance should result from proper utilization of the data-reduction capabilities of data-logging and computer-type accessories to automatic process control systems. The kind and quality of product and process data available should improve drastically. This, of course, should contribute to more precise and sophisticated evaluation of product and process capability and performance.

The relative complexity and expense of automatic production facilities will require that pre-investment planning should increase in detail and importance. The conceptual framework of this type of planning is closely allied to the quality planning advocated under total quality control. However, such pre-investment planning will require consideration of market surveys, cost analyses, production control and scheduling requirements as well as the more conventional technical areas of materials, machines and methods. In addition, the scope of analysis performed should expand due to a more intensive use of mathematical models of dynamic system behavior as elements of system simulation studies on computers.

Thus, we shall find Quality Control Engineering existing in a larger framework than at present. There will be increased requirements for the use of and the understanding of concepts and techniques from mathematical statistics, mathematical physics, systems engineering, and econometrics. Computer applications and techniques will be utilized increasingly. Techniques from information theory, game theory, queuing theory, linear programming and response surface analysis will be employed and improved upon. Non-linear systems will receive increasing attention since they represent many real situations that have heretofore been treated by engineers as a series of linear estimates which in many cases are proving inadequate.

This discussion has been offered to indicate that some of these problems are already with us and that many more are not far beyond tomorrow. It is important, therefore, that those now working in quality control become aware of both the necessity and the importance of these impending changes in order to continue to render worthwhile service in industry.

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Reliability of Guided Missiles

PAUL D. STROOP

Bureau of Naval Weapons, Washington, D.C.

I am most happy to take part in this annual convention of your society for several reasons. First, as a former chief of the Bureau of Ordnance, I continued the strong support and participation in the affairs of your society that had long been the habit of the Bureau.

I remember that Admiral George Hussey, wartime Chief of the Bureau and now Executive Secretary of the American Standards Association, took an early interest in quality control and encouraged the active participation of our Washington Headquarters and Field Station people in your meetings. This support has continued through the years.

Secondly, as Chief of the newly formed Bureau of Naval Weapons, resulting from the merger of the Bureau of Ordnance with the Navy's Bureau of Aeronautics, I hope to see a renewed and redoubled interest in your field.

At no time in history has it been as important for us, as a nation, to be more concerned with the quality and the reliability of our weapons systems.

I might observe that the merger of these two Bureaus of the Navy Department symbolizes the merging paths of the pilotless aircraft, the guided bomb, rocket and bullet, and the homing torpedo.

This merger also reflects the changing climate of our time.

I say this because the purpose of the merger was primarily to speed the flow of satisfactory missiles to the fleet, to cut down on the lead time required for development, and to improve reliability and performance of our weapons. The object also was to buy more time and more development with our limited dollars. We just simply have to go faster to keep up with the world we are living in today.

Now I would like to explore how these changing times, as well as the changing character of our weapons, greatly influence the contribution that quality control can make in our national effort. These questions raise the problem of whether this science has been sufficiently flexible for the times we are exploding into, whether or not industry has made full or optimum use of these methods, whether or not we can hope to save, or whether or not we shall have to pay a premium for quality and reliability.

I shall also touch on what we ourselves as customers and users, and what industry also, must do to obtain the maximum gain in performance.

Before discussing these problems, I should like to describe for you the Navy's missiles and to review some of the important changes taking place in the business of developing and producing them.

The Navy's missiles, to which our direct interest is limited, include Sidewinder, Sparrow, Bullpup, Corvus and Eagle in the air launched family; Terrier, Talos, and Asroc & Subroc for anti-submarine warfare; Tartar, surface to air category; and finally Polaris Fleet ballistic missile. Each of these serve specific purposes. The Sidewinder, for instance, is an air-to-air missile launched by aircraft for defense against other aircraft. Sidewinder is the smallest of the family, not much bigger actually than a sky rocket, it is relatively non-complex, but is extremely effective and efficient in seeking out jet fighters flying at supersonic speeds and destroying them.

The intermediate Terrier, a ground-to-air missile, is much larger, 19 feet long and more complex. It can find its air targets at very long range and with uncanny accuracy.

Polaris, the largest and most glamorous of the family, still under intensive development and already showing great promise, is to be launched from submerged atomic submarines.

Despite their differences, these weapons have much in common.

They are expendable and expensive, but most importantly, they must be reliable.

They must work when we need them and for the time required; they must last the course and they must reach their targets.

Background on Requirements

The requirements for effective functioning when needed have always been demanded of our weapons but the changing climate of the times, as well as the changing character of the weapons, make these requirements very difficult to realize. Missile requirements differ from those of civilian products: notably in the matter of shelf life, in lead time, in the importance of mass production, and in the increasing stress on scientific technology.

Shelf life is of the utmost importance. In any emergency the weapon must be ready to operate, no matter

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how long it has been stockpiled on the shelf, nor how little it has been used in token exercises and tests.

Because of the nature of our present weapons, there may be no second chance; no time as in the civilian market to evaluate a product, to improve it during production, or to withdraw it if it lacks necessary quality. On the other hand, *Time* magazine recently reported an interesting example of the withdrawal from the civilian market by the manufacturer of some 40,000 washer-dryers because of poor quality in use. We cannot follow this example for there will be no chance to correct such mistakes in military items. Long in advance we must pre-plan and pre-engineer the reliability and whatever quality that will be required for our needs.

Secondly, as our systems become more complex and more intricate in the race for competitive performance, the necessary lead time — or weapon development time — becomes longer. It is generally accepted that the complete development of a new weapon system takes from six to seven years. The system in this case includes the missile, the means of launching it, the radar to acquire the target, and the plane or ship or submarine from which it can be delivered. These must be meshed together, for one development is almost worthless without the corresponding development of nearly every other link in the chain. In other words, we must now be planning for those things which may not reach the usage stage, in the normal course, for nearly a decade.

Few civilian products require so long a gestation period. Incidentally, I might say that this weapon development time has been unsatisfactorily long and we must find the ways and means to compress it.

Thirdly, I might observe that mass production has become less important in relation to military requirements. Yesterday when America was the arsenal of democracy, the balance was tipped largely by material supremacy, by the amazing facility of this country to turn out enormous quantities of mass-produced items.

Given a period of time and necessary protection, our factories in World Wars I and II were able to produce more than enough to meet the needs of armed forces, difficult as that seemed at the time. World War II accelerated the military use of scientific and laboratory effort, as was dramatized by the spectacular breakthrough in the influence fuze and by the atomic bomb. Today, the premium is on scientific achievement rather than on mass production, and thus, as a nation, we see the degradation of what many of us have accepted as our greatest military asset, our productive capacity. Obviously our precepts, based upon mass production, must likewise yield to the exigencies of the times; quantity thinking must give way to quality thinking. We may not have to produce as much, but we have to be smarter in doing so.

The change in emphasis from mass production to low quantity high-value weapons presents another problem.

As the numbers contract and the costs per item increase, budgetary difficulties prevent adequate sampling for tests and qualifications. We must thus learn to use limited information more intelligently. This is a very real challenge.

Lastly, I might say that military requirements place increasingly greater emphasis on research and development rather than on production, and indeed on basic research itself. In this exploding technology (which we have today), we are thrown back in spirit to the Goliath type of conflict, where ideas and technology serve as our champions.

As this shift from a production orientation to a research orientation takes place, we need the means for evaluating the potential methods to be required at a future time for predicting results, for weeding out unpromising systems long before they reach the expensive production stage, and for concentrating our present efforts on those systems which will have the greatest potential usefulness in the future. Greater emphasis must be placed on reliability prediction techniques, the mathematical prediction of system results based on component or subsystem reliability blocks. Component life test and environmental data will be needed to fill these reliability blocks.

Such information must be used to determine the weakest links in order that redundancy, or other design arrangements, can be used to improve reliability where it is needed. We need such information not only with respect to quality and reliability, but also with respect to time, in order to concentrate effort, to shorten or compress developments expected to cause the longest delays.

In order to conserve effort we need to avoid duplicative testing especially of components, and to rely to a great extent on data exchange systems, making use of electronic computers and data handling for bringing this information together.

Akin to this, greater emphasis must be placed on the statistical design of experiments for evaluating research accomplishment, especially where small sampling applies; avoiding the rejection of really promising plans on too limited evidence, while, at the same time, rejecting those which might skim through with a lucky sample or two.

All of these requirements impose strains on competition as a means of controlling research effort, effective as it may be in guiding a production-oriented marketplace in producing optimum products at minimum costs.

All of this can be summed up by saying that we are living each day under circumstances essentially new and different. And in many ways it is apparent that we are not learning fast enough. Each new missile, for example, starts off with a long series of disappointments and with failure after failure, until each component, and the system, is finally searched for defects and they are corrected. It is reported that the Germans needed 1400 V-2's before they reached a satisfactory level of operability. On some of our smaller missiles we have expended as many as the Germans in the patient process of trying to correct mistakes or to overcome lack of knowledge through experience. Obviously with our larger missiles the IRBM's-FBM's, a trial and error approach is beyond both our productive and financial capacities.

We must learn how to incorporate quality and reliability in the design stage, and we must bring our necessary tests for conformance as closely to possible causes as is practicable.

The question that is germane to our discussion today is how quality control techniques can help us in the armed forces toward achieving the reliability which we need in minimum time and at minimum cost.

Are these techniques that have been so effective in raising quality in our mass production days sufficiently flexible to help in a research-oriented period?

The answer is certainly "no" if quality control is limited to inspection or to the in-line, after-the-fact control of production processes.

Perhaps none of you would wish to restrict your techniques to so limited an area of application; yet there is unfortunately a tendency to define quality control in terms of conformance to existing specifications and to inspection.

My concern is wider than mere terminology for there is a question in my mind, as there may be in yours, as to whether American industry has made optimum use of these quality techniques in the design and in the production of civilian products. The abundant evidence at hand of products needing repair, replacement or overhaul in the automotive, appliance and soft goods industries suggests that we, as a nation, have much to learn in the use of these techniques even where it is relatively easy to do. We might ask why have we not learned to avoid these expensive quality mistakes before they allowed sub-standard materials to pour on the market.

We might also ask why we have not in commercial practice assured the quality of products flowing to consumers though the development of standards, the improvement of specifications, adequate testing under expected environmental conditions at the design stage, by control of production, and by the feeding back of quality data from every stage of the process to each other.

Or, put it another way, have we conformed to the old adage that "Quality must be designed into a product; it cannot be inspected into it"?

Moreover, we cannot expect the complex and exotic military requirements of the missile age to out-distance the general state of the arts for any long period of time.

Besides this, a missile, however complex, is made up of many simple pieces and parts. Most of these may be subcontracted to, and manufactured by, hundreds of small producers who are mainly oriented to the civilian market.

Indeed some of the failures of our largest and most expensive missiles have in the past been attributed to the non-reliability of essentially civilian-type components.

A tremendous gain in our capacity to meet the requirements of the missile age might come from truly vigorous and effective wide-spread applications of these tested quality techniques throughout all our industries.

Broader Quality Control

But this in itself may not be enough. If quality control techniques, as I understand them, are to be of the greatest use in helping to meet our present military requirements, their orientation also must shift from a production to a research and development emphasis. They must change from a concern with the control of production and conformance to specifications to the broader concepts of assuring the quality and reliability of products in the widest sense.

Quality control methods, reflecting the application of scientific thinking to the control of the whole development, production, and use cycle, must reflect the changing purposes for which these methods are employed.

Quality control must certainly embrace what we in the Bureau of Ordnance have for some years called the "birth to death" concept, meaning that the concern for quality of product starts with the basic design and never stops until its final expenditure.

Military products require at least this and something more. In this day of exploding technology, and for the reasons of time, effectiveness, and certainty that I have explained above, we cannot wait for final product to tell what quality is obtained.

Instead, we must use information on component quality, and on interrelations of complex systems to predict all relevant aspects of the final product as soon as it leaves the drawing board.

Specifically, we need to know about the time required, the quality and reliability expected, the performance envelope, and the cost.

You may notice that I have avoided any sharp distinction between quality and reliability. I would rather leave these terms to the experts and to your technical discussions. What I have indicated is our requirement for material that will function in the manner intended and for the time required under the environmental situation encountered.

This concept is ordinarily associated with reliability, but I find it difficult to distinguish this notion of reliability from the broad concept of quality to which I have already alluded.

Moreover, despite the novelty of our present situation, I sense a danger in treating the situation as if it were entirely new and requiring a unique approach.

Specifically, I wonder whether we have gained either time or savings from the tendency of some managements to compartmentalize quality, reliability, value and other related skills. The coordination of these many skills under staff direction at high levels of management seems to me to be a very important step on the part of many of our progressive company managements.

Reliability of Existing Products

In stressing the reliability prediction of systems now in the design or development stage, I do not mean to neglect the efforts to improve the reliability of material already in the fleet. Such improvement may be necessary because of inadequacy of design, imperfections in production, or degradation in use through lack of training or improper handling. While such improvement and correction of existing material is important, the proper emphasis in such reliability improvement is on the avoidance of such troubles in the future.

From the fact that most known problems of reliability have arisen in connection with material in use, we cannot conclude that reliability is primarily the province of production or maintenance.

We must ensure correction on the second time around, if we have not been able to find the means to avoid it on the first.

Management

Were time available, I could relate the reliability developments in the VT Fuze, the Sidewinder and the Terrier missiles.

What we should find in such an examination is that the presently attained reliability has come from a wide variety of effort, including careful design, reliability prediction, environmental testing, well-planned and well-analyzed tests, and feedback of fleet and field information. The important thing is that quite satisfactory levels have been reached, although we have time and numbers to do so.

Because reliability is so much a part of everyone's effort, teamwork of a high order is necessary for its accomplishment. The teams are many and they include the teamwork between the designers and the

producers, and between each of these and those who ultimately use the products in the fleet.

Our Bureau organization serves as the means for implementing such teamwork.

Such teamwork is not a mere willingness to work together; it must be based on scientific information which provides the media of communication for all those playing on the team.

Within my own organization, I intend to emphasize program management discipline. This will involve tight allocation of money, time, materials and facilities among the 34 major programs that the Bureau is currently undertaking.

This program management concept is an attempt to gain the advantages of vertical organization making use of horizontal operating components.

For adequate control of this responsibility, program managers will need to have quantitative measures of expected or potential reliability as well as the other data that will enter their decisions. To them will be directed the often raised question "How much reliability can we afford?" Obviously we cannot afford to go all out on reliability for some items, and to neglect it in the case of others.

What we are thus seeking is a balance that is consistent with the forward progress of our technology.

This approach should also help to answer the questions of whether reliability is something extra which should be a distinct item for budgeting and planning purposes.

My attitude is that the achievement of reliability should be an inherent element of effective engineering and production. We do not expect to contract for the development and production of an item on the one hand, and to contract in addition for its reliability on the other.

There may in specific instances, however, be necessary expenses in connection with the early stages of product development for environmental test facilities, and life and destruction tests of components that may be necessary for ultimate achievement. We do not ordinarily expect to pay a thousand dollars for an item and another thousand for its reliability.

Supporting Program Management

This is the progressive research and development effort without which reliability could have no foundation. The wartime office of research and development left a heritage of capable weapons laboratories. These laboratories complement civilian industry on whom we depend to some degree in peacetime, and to a very considerable degree in wartime, to provide materials for mobilization. One of the major jobs of these laboratories is to produce documentation in order that industry can produce effectively.

In this documentation, we intend to avoid general statements about other characteristics of the product; instead specific reliability requirements expressed in mean-time-between-failures or in other appropriate dimensions based on objectively determined criteria will be used.

All our specifications will include such provisions in the future. These will be based upon:

A. Quantitative expression of reliability at points where it can be objectively determined and documented.

B. Use of reliability prediction techniques to assure the highest practicable inherent reliability.

C. Establishment of test program to confirm the predicted reliability at all component levels.

D. Assistance in selection of vendors capable of achieving required levels.

E. Closed-loop test and failure reporting system for continuous and progressive study of cause-effect relationships.

F. Provisions for quantitative demonstration of attained reliability.

In our organization we also place great stress on quality control. The concern of this function is with achieved reliability in connection with each of the programs of the bureau, a birth-to-death concept that meshes closely with program management. This group acts as the consumer side of the bureau, both with respect to the evaluation of materials purchased, and also with respect to materials in use in the fleet.

It strives to provide the system of technical intelligence, providing for the proper collection and analysis of usage, test and plant data, and making this available for designers, producers, and users of the equipment.

This quality effort is supported in the missile field by the Missile Evaluation Department NOL at Corona, Calif., which serves as the data collection center. Like the quality evaluation laboratories, it also provides many services in connection with the testing and evaluation of materials in the fleet. The laboratory facilities have been used increasingly for the environmental testing of parts and components to determine their suitability and reliability.

The quality control group also has to do with acceptance inspection and with the control of inspection documents. It follows the DOD policy of surveillance inspection, placing the prime responsibility on the contractors for controlling quality during production and for conducting required tests.

Key Points

In summary let me stress a few key points:

1. Our much vaunted mass-production capability is not so meaningful today as it was in the recent past. Today we need fewer, but more powerful and reliable weapons.

2. The Bureau of Naval Weapons recognizes its dependence upon industry to achieve its weapons objectives: it also recognizes the impact of its new quality and reliability requirements.

3. Both government and industry must exploit more aggressively all the scientific techniques, particularly the mathematical ones, for upgrading reliability.

Quality techniques should play a part, both in raising standards throughout small scale industry as well as in providing greater assistance in research and development.

4. Since weapons are fantastically expensive, dollars must be stretched as far as possible.

Our previous techniques have not been effective enough. Both government and industry must take measures to separate the men from the boys, those who can produce reliable parts at reasonable cost from those who cannot.

5. Lastly, component and material reliability data, being costly and scarce, must be shared as widely as possible. Duplicative testing must be avoided.

In organizing the new Bureau of Naval Weapons, I have attempted to emphasize these points and their attainment. I commend them to you for your own consideration.

DR. J. STUART HUNTER RECEIVES THE 1960 BRUMBAUGH AWARD

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BOOK REVIEWS

W. D. Baten, Editor
26 University Drive, East Lansing, Mich.

LINEAR PROGRAMMING: METHODS AND APPLICATIONS by Saul I. Gass, McGraw-Hill Book Co., Inc. New York, N.Y., 1958, $6.75. pages vii-223. Reviewed by Dr. Robert F. Hutton, College of Agriculture, Pennsylvania State University.

This book is designed for use as a college text for linear programming courses. According to the author " . . . this text is appropriate for use in mathematics courses at the senior or first-year-graduate level." The author added, "However, because of the interest in linear-programming methods outside the academic field, it seemed advisable to include sufficient material on matrices and vectors to make the work complete for all readers." (p. viii).

In light of the alternatives that are open to those "outside the academic field," I can't imagine this book being of serious interest to this group. It is much more involved in the mathematics of linear programming than is necessary for a working understanding and than the usual business executive, accountant, plant manager, nutritionist or engineer is apt to appreciate. I can be more positive in recommending that such persons *not* start their study of the subject with this book. It is apt to be very demoralizing and kill any interest that existed in the subject. This comment applies to the book in its entirety. There are some parts in most chapters and virtually all of Chapter 11 that can be read with interest and understanding if the formal mathematics treatment is ignored.*

Thus in my opinion, this book must be seriously considered only as a college text. If he intends that this text be used by the graduate student without the equivalent of third-year college mathematics, I think his book is subject to the same criticism as that directed above to its use by those of non-academic interest. That is, if the object is to teach students without mathematical background the elements necessary to their making application to problems they may encounter in their subject matter fields, this is a very poor choice of teaching material and approach. By its emphasis, it creates the impression that the mathematical aspects of the question are the important aspects. It will be only the exceptional student who, lacking mathematical background, would survive his ego sufficiently intact to venture forth into areas of practical application.

This leaves as a possible area of usefulness that of a text for advanced level undergraduates in mathematics or graduate students in other subject matter fields with equivalent mathematical comprehension. I must judge this use not as a teacher of mathematics, but as one who has taught linear programming. My impression is that the material would be very tedious for such students. In the relatively few instances in which I have had the opportunity to instruct persons with good mathematical background in linear programming, my task was extremely easy. Sessions of one to two hours were adequate. From this, I would judge that the hundred odd pages devoted to exposition of method would be rather tedious *if the objective were to gain a practical grasp of linear programming.* The formal statement of the essential theorems and their proofs that occupy such a prominent place in this text probably would be of little interest in this connection. Linear programming is an established technique, and the proof of its essential theorems appears to be a comfortably accepted fact with such students. Thus, this may be a good book to suggest that such a student read but not one to recommend as a text for a course. As a matter of fact, I seriously doubt that a text is needed for such students or that students of this description should be enrolled in a course in linear programming. Unless the course is of a very applied nature in subject matter fields in which these students have interest, but little knowledge, their time is apt to be inefficiently utilized.

This elimination procedure leaves as a group of possible students the mathematics majors who are interested in the exploration of the foundations of this technique rather than in its practical application. I suspect that such students would find this an excellent place to begin their studies. This book gives the historical evolution of the technique, is carefully documented and has a good bibliography of basic works. Again, however, I cannot visualize the use of this book as a course text even for such students. The basic sources are of such recent origin and so readily accessible to students of this category as to make the usefulness of any text questionable.

A group of potential readers that may find this book useful are those who have had considerable experience in use of linear programming but lack command of the mathematical aspects of the technique or who do not fully comprehend the numerous articles that discuss linear programming in technical jargon. This book should serve to help them bridge the gap between the intuitive understanding they have gained from their experience and that necessary to comprehend this literature.

The nature of this content of the book should be obvious from these foregoing comments. However to be more explicit, the core of the subject matter involves the statement and proof of the theorems associated with linear programming technique. The computational techniques are presented and discussed in terms primarily of their formal mathematical characteristics, but these discussions were supplemented by illustrations that indicated the mechanics of a solution routine that employ these mathematical characteristics. I gained the impression that the illustration of applications were used to illuminate the discussion of the mathematical characteristics being used to further understanding of the solution routine. There were attempts to give geometric interpretations to many of the points but these tended, in my opinion, to help very little if at all.

There is a major section upon applications. However, again the author seems to have concentrated upon the applications that are mathematically interesting rather than those of general interest.

The kinship of the Leontief Input-Output models and certain theory-of-games models to linear programming is noted. In what seems to be a peculiar emphasis, the input-output model received some six pages of discussion, and the theory games discussion received treatment in a separate 15-page chapter. The discussion of the input-output model was inadequate compared to other treatments of the subject. The treatment of theory of games was better, but the author made no contribution that would tend to raise it from the status of an intellectual toy.

Appended to the text is a bibliography that is, of course, now out of date and is selected from a much more comprehensive bibliography than is available in published form.

*For those readers who have some interest in familiarizing themselves with this technique, I would like to make the point that you can do so—even to solving problems—without understanding the mathematics involved. For some reason most writers on the subject unnecessarily embroider the discussion, even for non-academic audiences, with mathematical notation not in common usage. But, the subject embraces a set of very straightforward common sense ideas that can be explained in the language of common use.

Management's Corner

J. M. JURAN, *Editor*

Pareto, Lorenz, Cournot, Bernoulli, Juran and Others

J. M. JURAN

Many years ago this department, then a young engineer in Western Electric Company, "discovered" that quality losses are heavily concentrated in a few major defects. This was, of course, a rediscovery of what practical men* have known for centuries.

In later years, this department was faced with coining a shorthand name for this phenomenon to simplify the writing of reports, papers and books. In such situations authors may search the past to find the name of an historical principal contributor to the evolution of the new knowledge.†

In this case the search only disclosed, on this phenomenon, that industrial recorded history is very sparse.

An obvious parallel to the phenomenon was the way in which wealth and incomes were concentrated (a subject which this department has also studied for industry). In contrast to the sparseness of a written historical record on defect concentration, the written historical record on wealth and income concentration is extensive.

Statistical data on wealth and incomes go back for centuries, since landholdings, size of dairy herds, amount of agricultural production, etc., have traditionally interested the public tax collector. However, the pioneering effort to state a law of income distribution appears to have been made by the Italian sociologist Vilfredo Pareto (1848-1923). For this reason, his name was identified (by this department) with the phenomenon of defect concentration. This identification probably commenced in the late 1930's. Its spread into industry generally dates from the late 1940's when the matter was given prominence in the Management Round Tables conducted at New York University. With the publication of Juran's *Quality Control Handbook* (McGraw-Hill) in 1951, the identification spread rapidly and very likely has become rooted in industry.

Pareto's "law" of income distribution was published in *Manuale d' Economia Politica* (1906). The formula is:

$\log N = \log A - \alpha \log x$, where

N = number of individuals,

x = income size

A, α = constants derived from the empirical statistics.

Pareto's "law" has come in for some rough treatment. *The Encyclopedia of the Social Sciences* concludes that "the statistical basis . . . has been so severely criticized that it is not now generally accepted." But right or wrong, he tried. In any event, his place in history rests on something else, i.e., the massive "Trattato" wherein he undertook to classify human conduct and to discover equations to explain such conduct.

Since 1951, various questions have been raised to the effect that Pareto was the wrong man to identify with the concentration of defects. A number of candidates have been nominated. These will now be discussed, but it is likely that the discussion is only of academic interest. The election is probably over and it will probably remain Pareto's law.*

Applying the concentration law to the candidates, only two warrant extensive discussion.

If the identification problem were being faced for the first time, we would identify the concentration phenomenon with M. O. Lorenz. In his paper "Methods of Measuring the Concentration of Wealth," *American Statistical Association Publication* Vol. 9 (1904-1905) p. 209-219, Lorenz depicted the concentration of wealth in the now familiar curves, using cumulative percent of population on one axis and cumulative percent of wealth on the other. These axes are arithmetic, not logarithmic. They ante-date the publication of Pareto's law. In *Quality Control Handbook*, the figures on page 40, while labeled "Pareto's principle" are actually Lorenz type curves.

Antoine Augustin Cournot (1801-1877), French economist and mathematician, is generally credited as the pioneer in application of mathematics to the treatment of economic questions (Reserches sur les principes mathematiques de la theorie des richesses —1838). However, it does not appear that Cournot defined a law or principle dealing specifically with the phenomenon of concentration.

Daniel Bernoulli (1700-1782) of the famed Swiss family of scientists and mathematicians, developed an equation relating size of income and "welfare" which is likewise not pertinent to the concentration problem.

Other candidates — Gini, Gibrat, Dalton, Gramer, etc. must be dismissed on grounds of priority.

We may well conclude that we have done Mr. Lorenz an injustice. The economists freely use the "Lorenz curves", referring to them by that name, not by the name of Pareto. We will do our best to make amends but it is probably too late.

ASQC LCS Code 000:00:000

*Note the following extracts from 18th century correspondence in James Watt's company (Boulton and Watt):

Production to Sales: "Why dost thou not send a list of particulars instead of saying simply and in general that things do not fit?"

Sales to Production: "The wheels of the implanted motion are so bad that they must be replaced with new ones. The connection rod top has broken. The connection rod gudgeons have a slot the full thickness of a worn shilling. The racks and sectors are badly fitted, and many other matters."

Production to Engineering: "We beg that you pay more attention to the matter of the flanges on the castings. We have had much reason to complain of this part hitherto, and we have been obliged to chisel out the irons to the proper cone. This expense might well be saved by some attention paid by you."

†Sometimes authors are tempted to live in the present, and to coin a name which makes them discoverers rather than rediscoverers.

*There is precedent for such wrong identification. In 1857, H. D. Macleod summarized a law of money "bad money drives out the good." He called it Gresham's law under the belief that Sir Thomas Gresham had first explained the principle in 1558. Actually the principle had been set out earlier by various other writers on economics, i.e., Oresme and Copernicus. But Gresham's law it remains to this day.

SUPERVISOR'S CIRCLE

PAUL A. ROBERT, *Editor*

Precision Products Co. of Cincinnati, Box 130, Norwood 12, Ohio

Geometric and Positional Tolerancing

ANNE L. FONTAINE, ***American-Standard Plumbing & Heating Division***
Plumbing Fittings Section of American Radiator and Standard Sanitary Corp.

What It Is

Geometric and positional tolerancing? What is it? Is it something new for the outer-space exporers? Do we need it? What's wrong with our old system of tolerancing? We haven't done so badly with the old system!

More questions? Of course—but let's stop right here and go back to the first two questions. Geometric and positional tolerancing—what is it? To over simplify—geometric tolerances are tolerances of form. Positional tolerances are tolerances of location.

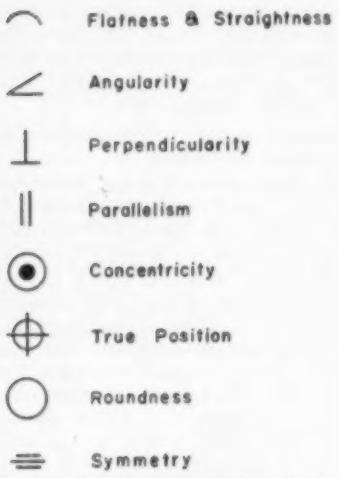


Figure 1—Geometric Characteristic Symbols (Adapted from MIL-STD-8B)

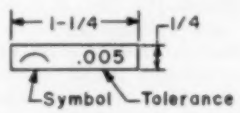
ASQC LCS Code 120;713:60;70:400
Figures accompanying this article are from MIL-STD-8B by Robert L. Davis.

Third question—No, it isn't new and it isn't just for missile or rocket work. Geometric and positional tolerances are used where interchangeability of parts is required. Is there any industry in which interchangeability hasn't become a point of issue at one time or another? So much for the fourth question.

Now the fifth question. There isn't anything wrong with the old system of tolerancing—so long as everyone concerned interprets the tolerances in exactly the same manner. And "everyone" includes engineer, designer, draftsman, tool maker, machinist, inspector, and quality control and purchasing personnel and all the vendors. How well have you done, particularly with this problem of form and interchangeability? How consistently well?

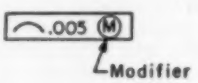
Why

There have been sufficient misunderstandings and misinterpretations stemming from tolerancing practices to prompt the Society of Automotive Engineers, the American Standards Association, the U. S. Defense Department, both the British and Canadian Standards Associations, and various other associations over the years, to establish uniform methods of tolerancing geometric and positional



(A)

Feature Control Symbol With Tolerance



(B)

Feature Control Symbol With Modifier

Ⓜ (MMC) Maximum Material Condition

Ⓢ (RFS) Regardless of Feature Size

(C)

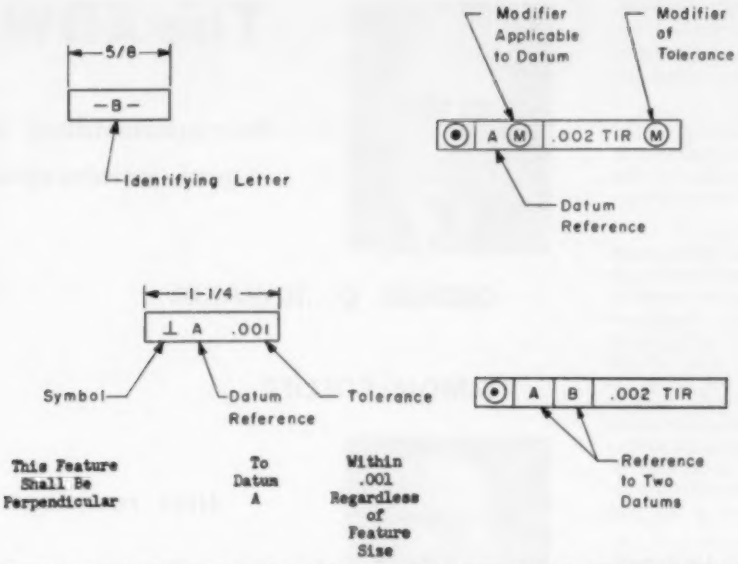
Figure 2—Modifiers—The Use of the Symbols M and S are Restricted to the Feature Control Symbol. The Abbreviations MMC and RFS Apply to Both the Toleranced Features and to Datum References.

Quality Control Methods Employed In 1960 Census

An important innovation in the 1960 census has been the introduction of quality control methods into field operations.

The Bureau of Census succeeded in developing procedures which enabled the supervisory staff to detect faulty enumeration work more consistently and more promptly than ever before—in time to take action before the work had been substantially completed. Enumerators whose work was found to be deficient were in many cases given instruction which enabled them to perform satisfactorily; in other cases, they were removed from the rolls and their work was reassigned.

As a result of this operation, more than 4,000 enumerators were replaced. This enabled the Bureau to eliminate some of the types of problems which would otherwise have delayed the later stages of the census and impaired the quality of the results.



Figures 3, 4, 5, 6—Upper Left, Datum Identifying Symbol; Lower Left, Feature Control Symbol With Datum Reference And Tolerance; Upper Right, Datum and Feature Symbol Controlled by a Modifier, and Lower Right, Feature Control Symbol Referenced to Two Datums.

characteristics. This article will be concerned primarily with the Defense Department's MIL-STD-8B (Military Standard 8B), the most recent revision, which is mandatory for use by the Army, Navy and Air Force, and from which numerous industries have taken their cue in standardizing their tolerancing practices.

Geometric and positional tolerancing? Geometric and positional characteristics? Right—the precise shape, size, location and relationship of all surfaces and features are defined by this method of tolerancing the characteristics of form and location.

Remember, this method of tolerancing does not obsolete accepted dimensional tolerancing practices. It is to be used where a greater degree of accuracy or clarity is required than can be obtained by ordinary or accepted shop practice. It is essential when the form or location of a feature is critical to its functioning or interchangeability.

Symbols

The use of symbols has the advantage of providing more complete drawings, expressing exact design requirements of interchangeability, leaving nothing to the imagination, and permitting no argument as to what is required. All of which greatly facilitates manufacturing and inspection requirements. It also assures interchangeability when parts are purchased from a number of different manufacturing sources, and this in turn, eliminates rejection of usable material. The Defense Department has developed a set of eight symbols (Fig. 1) to identify the geometric characteristics being toleranced. They are used in lieu of, or in conjunction with, notes on drawings to indicate the relationship of the characteristic to its basic condition or other features. The method of showing the characteristic symbol with its related tolerance is shown in (Fig. 2A). Exceptions to the general rules governing the application of these symbols are expressed by the addition of a modifier symbol (Fig. 2B), to the feature control symbol.

The modifiers (Fig. 2C) will be explained in detail in a later installment, but briefly their application means: MMC (M), the tolerance applies at maximum material condition and is increased as the feature departs from MMC by the amount of such departure; RFS (S), this tolerance must be adhered to regardless of the actual size to which the feature is produced.

Tolerance Zone

Just what is a geometric tolerance, or tolerance of form? Variations in form are permitted because it is mechanically impossible to produce a perfect form. A dimensional tolerance limits size, but unless otherwise noted on a drawing, any variation in form will be acceptable so long as the part is within the dimensional limits. When the part is given a geometric tolerance, a tolerance zone is established and the surface, axis or median plane of the feature, must lie within the width or diameter of the zone. Furthermore, the tolerance is usually specified for the entire surface, axis or median plane, regardless of its length or area. In some instances, the tolerance may be specified in terms of linear deviation per unit of length or area. Usually the tolerance zone is less than the dimensional tolerance, and all tolerances specified, for true position and form, are totals. Terms such as DIA, TIR, TOTAL, or WIDE ZONE emphasize the fact that the tolerance is total.

Datum Surfaces

In this system, the tolerance is usually given with reference to a datum surface or feature which is identified by a reference letter (Fig. 3). All measurements are taken from the datum so it must not only be available, it must be more accurate than variations allowed in measurements made from it. The datum accuracy may be controlled by close tolerances on its geometric form and is also subject to the application of a modifier. (Figs. 4 and 5)

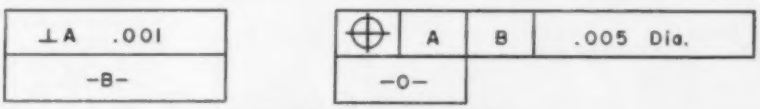


Figure 7—The Feature as a Datum

The geometric tolerance may be given with reference to two datums (Fig. 6), and the feature itself serve as a datum, in which case the feature control symbol and the datum identifying symbol are both shown (see Fig. 7).

Symbol Definitions

Definitions of the geometric characteristics symbols and their application will be treated in the next installment of this article.

The EDWAR

for outstanding leade and administration

GEORGE D. EDWARDS

SIMON COLLIER

first recipient of M

President Fisher Pre

A significant stride in the ASQC Awards Program was made on Feb. 19, 1960, when the Society approved the recommendation of the Awards Committee for the establishment of a new award, to be called the Edwards Medal.

The action was taken by the Society's Board of Directors in a resolution which is reproduced here. It culminated several years of intensive study by the Awards Committee and is regarded as a major contribution to the Society's award structure.

Many persons in the Society have long recognized that outstanding contributions are being made to quality control in industry by persons who are not necessarily qualified to be the recipient of the Society's Shewhart Medal. The Shewhart Medal honors those who make outstanding contributions to the science and art of quality control in the technological sense; the Edwards Medal has been designed to honor those who, though they may not be expert in the science, have nevertheless made signal contributions through outstanding administrative service either to quality control programs in industry or to the Society. With the establishment of the Edwards Medal, the Society has filled a big gap in its awards.

The announcement of the new award and the presentation of the first medal and an engrossed plaque of the Board Resolution was made to George D. Edwards at the Society's Annual Banquet by President C. E. Fisher.

Address by George D. Edwards

I find it extremely difficult to express my feelings on this occasion. Over the fourteen years of the Society's life, you have showered me continually with honors, until you exhausted all of those at your disposal. And now, in the true tradition of professional Quality Control people, your ingenuity and your imagination have produced a brand new honor, one far beyond any worthiness of mine, and it is piled on top of all the others.

I am deeply grateful to you all.

Quite a few years ago, I was rightly quoted in a kidding sort of way, of course, as having admitted that this Society is the apple of my eye.

And the fact that this is true makes these honors that you have heaped upon me more cherished and dearer to me than if they had come from almost any other source.

No one suggested to me that I should feign a look of surprise upon receiving this first specimen from the die of Mr. Weinman's talented work. As you may just possibly have suspected, I have known of it for quite a little time now, and I assure you that I have been reaping enjoyment of that knowledge to the full.

In fact, I had the pleasure, a month or so ago, of going over to New York for several days of sittings with Mr. Weinman. And I found him not only a talented sculptor, but a most charming and versatile gentleman.

From my own point of view, he has created a very satisfying likeness, though I am afraid he has flattered me considerably. Were it not for the so-called "high forehead" he has given me, which is of course nothing but a true-to-life great big bald-spot, the likeness might almost be taken for that of a fairly young fellow. That high forehead has been pretty effective in recent years, however, in silencing the "how *young* you look" chorus.

But Mr. Weinman did demonstrate pretty effectively that even I am not too old to learn, and particularly, to break habits. Of course I spent most of my time in his studio, seated on what he called "the throne." After several hours of repeated cautioning, I think he finally succeeded in pretty well curing me of an unrealized bad habit which some of you may well have noted and never mentioned to me — a habit of cocking my head at crazy angles.

I mentioned "the throne" in Mr. Weinman's studio. Believe me, that throne was not nearly as regal as it

Resolution of the Board of Directors

WHEREAS the Awards Committee of this Society has proposed in writing to this Board that it establish a new Medal to be awarded for

"Outstanding leadership in the American Society for Quality Control and in the practical use of modern methods of quality control, especially by application procedures, or by the organization and administration of quality control work,"

and

WHEREAS said Committee has proposed that this new honor be designated the

EDWARDS MEDAL

in honor of George D. Edwards, first President of the Society and distinguished pioneer in the administration, organization and development of quality control, now therefore be it

RESOLVED that this Board, meeting in regular session at New York on Friday, the Nineteenth day of February, Nineteen Hundred Sixty, does designate said new honor the

EDWARDS MEDAL
of the
AMERICAN SOCIETY FOR QUALITY CONTROL

and be it further

RESOLVED that the President of this Society is hereby authorized and directed to have created and struck a Medal of approved design and to arrange for the presentation of the first such Medal to George D. Edwards,

and be it further

RESOLVED that the President and Executive Secretary are hereby authorized and directed to execute and present to Mr. Edwards at an early date a copy of this Resolution.

/S/ David S. Chambers
Executive Secretary

/S/ C. E. Fisher
President

...S MEDAL

...ip in ASQC and in the organization ... quality control, named in honor of

...al

...nts Awards at 14th Convention Banquet

sounds. It consisted in an old straight office chair standing on an inverted packing case. One mounted it by stepping up on a smaller inverted packing case, and believe me, a mis-step could be painful.

But Mr. Weinman wasn't nearly so successful in curing another and much older habit of mine, the habit of sticking my neck out. It seemed as though about every five minutes, he would caution me to "drop my chin." And five minutes later, I would have it up again.

As I said, sticking my neck out is a much older habit of mine, and one of which I have often been painfully aware. As many of you know only too well, I have been doing it in this Society for 14 years, and I had been doing it for a long time before that.

You know, this habit of sticking your neck out has its compensations though, as well as its disappointments.

The fellow who never does it, never leaves much of a lasting impression on anything on which he works, and he never gets as much real satisfaction out of his work as he might otherwise.

But maximum success in sticking your neck out involves two things: the first is being right, and the second is timing. You never get anything but the disappointments when you're wrong, no matter what the timing, and if you're right, you'll probably achieve some good, no matter what the timing.

But you'll get the maximum of results, and hence the maximum of compensatory satisfaction, if you're both right and timed to the optimum.

So I beg of you — individually, and as a Society — be sure you're right, pick your time as well as you can, and then stick your neck out. You'll win enough of the time to be thoroughly compensated.

Now, how to be sure you're right!

I could scarcely hope to be very helpful to any of you on this point in connection with your individual problems.

But there are certain guideposts to which I would like to call your attention in connection with your steering of the Society in the years to come.

These fall under three headings — maturity, financial stability, and professional soundness — and I believe I have mentioned them in their order of importance.

Maturity is certainly prerequisite to both *financial stability* and *professional soundness.*

Real maturity requires recognition of the degree of maturity that you have attained at any particular time. Remember that while ASQC is 14 years old, it is still a child as compared with the major professional societies.

As an example, I enrolled as a student in the American Institute of Electrical Engineers 47 years ago. Even at that time, AIEE was twice as old as ASQC is now.

ASQC includes many mature and experienced individuals in its membership, but that membership, as a whole, is even less mature than the Society, so far as knowledge and experience in running a large professional organization is concerned.

For another example, it took me 35 years to become a Fellow of AIEE. (Incidentally, I don't understand *yet,* quite how I made it.)

But I don't believe *anyone* who joined AIEE around the time that I did, became a Fellow in less than about 20 years.

In *that* kind of terms, gentlemen, the skeptic might even claim that ASQC is operating a Fellow-mill.

My point is:

> Be sure you're not trying to put on long pants too soon.
>
> Recognize that even highly successful experience and maturity acquired in running one, or even several individual jobs, doesn't automatically provide anybody with knowledge of how to run a professional society.

So be sure that, in its conduct, your Society maintains dignified reserve; and that, as it gradually acquires

President C. E. Fisher introduces Simon Collier, 1960 Edwards Medalist, during the Annual ASQC Banquet May 25, 1960, at the Sheraton-Palace Hotel, San Francisco, Calif.

maturity, it takes its place and carries its share of the load of the professional societies in serving the needs of our country and of mankind.

This dignity and maturity will stand you in excellent stead in the maintenance of your financial soundness and stability. It will avoid spending beyond your income. It will avoid spending for ostentation, and for other purposes unbecoming a professional society. And it will assure maintenance of an adequate financial reserve to tide you over the lean periods which are bound to come from time to time. This does *not* mean piling up capital funds *without limit.*

But failure to maintain financial soundness and stability can wreck the Society more quickly than almost any other policy which could be adopted.

Incidentally, gentlemen, I think you are to be congratulated upon the present excellent financial condition of the Society.

Finally, I come to this matter of *professional soundness.*

Our Society must be governed by the same kind of professional principles that must govern its members individually if they are to be truly professional people.

That is:

> The Society must aid, in every legitimate way possible, in advancing the technical state and the application of the quality control art, and in informing its members as to such advances.
>
> The Society must not resort to unbecoming methods of promotion, either for its own gain or for the gain of its members. The Society must hold itself always at the service of our Government, particularly in time of war.
>
> And finally, the Society must conduct itself always with that dignity and decorum which becomes a professional organization of mature technical people — avoiding the rahrah and hoorah stuff which calls attention to itself in an unbecoming manner.

Again, gentlemen, I think you are to be congratulated upon the progress our Society has made so far in attaining truly professional status.

I have stuck my neck out again, in mentioning these things to you, not because I think our Society has done too badly with respect to them, but because I think it is good for all of us to put our guide-posts up in front of us once in a while, and to measure our performance against them.

For earnest people like the membership of ASQC, I am confident *that* is all that is necessary to insure an even brighter future for our Society.

Thank you all again for the superb honor you have done me. I assure you that this medal will take its place among my choicest possessions.

President Fisher then announced that the Society's Executive Committee, acting as the Medalist Committee for this first year, had selected to honor as the first Edwards Medalist, Simon Collier, past president of the Society and retired director of quality for Johns-Manville Corp.

Mr. Collier selected Prof. Ellis R. Ott to act as his sponsor. Prof. Ott's introductory remarks and Mr. Collier's address follow.

Ellis R. Ott Sponsors 1960 Edwards Medalist

In the early days of ASQC, which means since its founding in 1946, actually 40 years after the San Francisco earthquake, tremors and difficulties of varying intensities ran up and down our Society.

In fact, Si Collier says, that early Society activities required him to beg, borrow or steal in order to keep this Society in motion.

If you are in doubt, I am here to honor Si.

He was a founding member of our Society, and served it in various officer capacities including executive secretary, vice president and president during the years 1948-1953.

Let me tell you more about this past-president of our Society:

After receiving his B. S. in chemistry from Worcester Polytechnic Institute in 1916, he accepted an assistant chemist and later an associate chemist in charge of the work on rubber from 1917-18 and 1919-1923 at the National Bureau of Standards, Washington, D. C.

Then, in 1923, Si joined the Johns-Manville Corp., first, as manager of inspection and control at their factory in Waukegan, Ill., then subsequently as staff manager of inspection and control at headquarters in New York, and finally as director of quality control of Johns-Manville Corp. from 1946 to July 1, 1959, when he retired after 36½ years.

Currently, he is quality control consultant with a specialty in asbestos and rubber products.

His professional stature is best indicated by his record of professional services:

Chairman of American Society of Testing Materials Committee D-11 on Rubber and Rubber-like products since 1944.

Chairman of American Society of Testing Materials Committee E-11 on Quality Control since 1958.

Secretary of American Society for Testing Materials Committee C-17 on asbestos cement products.

Fellow of the American Institute of Chemists.

Fellow of the American Society for Quality Control.

Formerly a member of the Board of Directors of the American Society for Testing Materials, Chairman of the Chicago Rubber Group and the New York Rubber Group.

These have been important posts and suggest his professional and administrative services.

I would further now like to talk about Si and about his wonderful human traits — for although he is no saint, I recommend that you not get into a poker game with him.

First of all, Si is known and loved for his personal characteristics.

His modesty, his loyalty and his friends, who are legion, his unselfish availability to help any group within our Society without regard to himself or his good wife, Ida, who could not be with us tonight.

Si has traveled up and down North America and has given some 700 talks. He has shown the Johns-Manville film to some 70,000 people.

Simon Collier, we are honored to honor you tonight for outstanding leadership in the practical applications of quality control — will you please join us here.

Acceptance Speech By Simon Collier

When I received a letter some weeks ago from Gene Fisher, our President, advising me that I had been selected by the Society to be the first recipient of the Edwards Medal, I can assure all of you that I was a very happy individual.

In fact, I immediately wrote Gene to confirm my acceptance — just to be sure that the honor might not be withdrawn.

In accepting this award I am doing so, fully recognizing that I never could have been nominated if I had

not had the loyal support of my fellow workmen in Johns-Manville.

It was this loyal support that made it possible for us to carry on this extra curricular program of presenting our film "Modern Quality Control" and to outline the methods we used to establish and carry through our quality control program.

It enabled us to present this program before groups in industry, in other technical societies, in universities and in ASQC meetings for a total attendance of over 70,000 people.

As the years have gone by, I have learned that of the four major elements involved in production, namely, materials, machines, processes and men, that the most important is "Men."

I would state that unless we recognize this fact and make the necessary plans to obtain utmost cooperation from everyone involved, the best results can rarely be obtained no matter how good we plan our programs.

I was very pleased to have heard Rudolph F. Bannow, President of the National Association of Manufacturers, in his keynote address in opening this 14th Annual Convention of ASQC here in San Francisco, stress the need of obtaining the whole hearted support of everyone involved in an operation, if our country's economy is to be such that we continue to maintain world leadership.

This same important element "People" applies to the continued success of our Society.

We are now indebted to that dedicated early small group of men who recognized that our American industry could make sound progress only if we somehow taught industry to utilize the principles of a sound, well-planned quality control program.

How sound they were in their thinking and methods of approach is evidenced by this excellent 14th Annual Convention and our membership which now exceeds 12,000.

We must be thankful not only to this small original group of dedicated men — but, also, that now the good work is being continued by many more dedicated men.

However, we must never permit ourselves to become complacent — for mere members is not the whole answer to progress, quality of membership is of utmost importance.

We must diligently continue to explore ways and means of educating the greater number of industries and people who, as yet, have no conception of quality control principles or how to use them,

Therefore, I urge that:

1. The excellent work of the Program and Speakers Committee, especially the work of cooperating with other technical societies, be even more actively carried through — for by so doing all will work together and eliminate the formation of new splinter societies, and the resulting overlapping of efforts.
2. I believe we might step-up our help to those industries, and there are many of them, that do not understand what Quality Control can do to help them produce quality goods at the most economical costs.

One way to do it is for each section and division to review carefully it's membership, then make personal contacts with those companies that as yet have not affiliated themselves with our Society. And by this means somehow persuade them to come to our meetings and find out the value of quality control principles.

I feel certain by such a program we will increase the knowledge of our country's industry so that it may continue to lead the world in this field.

In closing, I wish to sincerely thank the Society for this honor they have bestowed on me.

4th ASQC

Workshop-Seminar

Management of Quality Control

STATLER HILTON HOTEL, OCTOBER 6-8

ST. LOUIS, MISSOURI

Industry is giving Quality Control a great deal of emphasis because of its potential for improving product quality while increasing productivity and reducing related costs. This increased scope of quality control has multiplied the responsibilities of the Quality Manager. To help him fulfill his new role, the American Society for Quality Control will conduct a workshop-seminar on Management of Quality Control for the three days of Oct. 6, 7 and 8.

What is the purpose of the workshop seminar? To explore in depth, tested methods of increasing the effectiveness of the quality control program in an industrial plant.

For whom is the program planned? For present and prospective Quality Managers. It is expected that the applicant will have reasonable familiarity with such standard texts as Grant, Feigenbaum, and Juran. To benefit properly from the seminar, the applicant should have a minimum of several years experience with major responsibility for quality.

Who will direct and conduct the program? The Director will be Paul C. Clifford, Professor at Montclair State College. Speakers and Discussion Leaders will include managers of outstanding quality control programs.

Registrants will be sent study materials and case studies prior to the conference. Registration is limited to 75 persons and is complete only on receipt of the registration fee of $125 for non-members, $100 for members, which includes the cost of three lunches.

Your Registration will be acknowledged. A room reservation card for the Statler Hilton Hotel will be enclosed with the acknowledgment.

From 8:30 am on Oct. 6 until 8:00 pm on Oct. 8 registrants will have a full schedule, including evenings. The title WORKSHOP has been chosen deliberately.

Fourth ASQC Workshop - Seminar
American Society for Quality Control
161 West Wisconsin Avenue
Milwaukee 3, Wisconsin

Please make reservations for the fourth ASQC Workshop-Seminar on Management of Quality Control for the following man who satisfies the registration requirements as indicated in the announcement.

Enclosed is our check for $..... to cover..... registrants. Fee—$125 for non-members, $100 for members.

Name .....

Title .....

Company .....

Address .....

City.....Zone No. ....State.....

NOTE: Additional registrations may be made by attaching a list to the above coupon. Please include necessary information for each registrant.

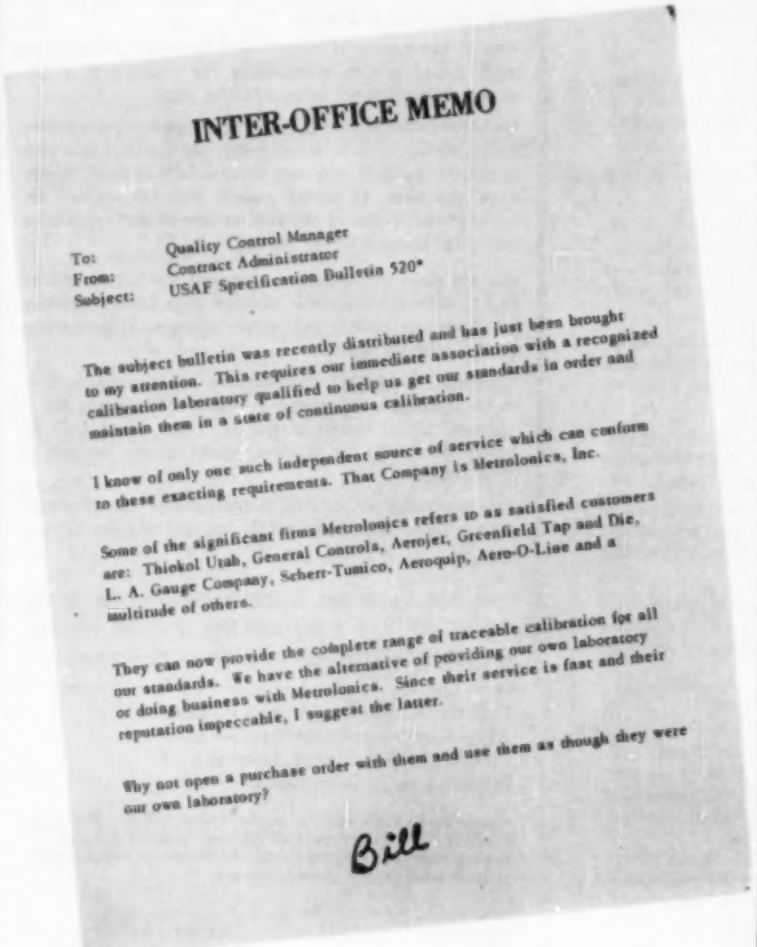
How to Transfer Your Section Affiliation

A number of members have asked how to go about transferring to a new ASQC section when they move.

The procedure is easy.

Just drop a post card to the Society headquarters office in Milwaukee, indicating both your old and new address. Or if you have already moved and now wish to transfer to the section nearest your residence, indicate the section to which you now belong and the one into which you wish to transfer.

We will take it from there, correcting our records and notifying the secretaries of both sections for you.



INTER-OFFICE MEMO

To: Quality Control Manager
From: Contract Administrator
Subject: USAF Specification Bulletin 520*

The subject bulletin was recently distributed and has just been brought to my attention. This requires our immediate association with a recognized calibration laboratory qualified to help us get our standards in order and maintain them in a state of continuous calibration.

I know of only one such independent source of service which can conform to these exacting requirements. That Company is Metrolonics, Inc.

Some of the significant firms Metrolonics refers to as satisfied customers are: Thiokol Utah, General Controls, Aerojet, Greenfield Tap and Die, L. A. Gauge Company, Scherr-Tumico, Aeroquip, Aero-O-Line and a multitude of others.

They can now provide the complete range of traceable calibration for all our standards. We have the alternative of providing our own laboratory or doing business with Metrolonics. Since their service is fast and their reputation impeccable, I suggest the latter.

Why not open a purchase order with them and use them as though they were our own laboratory?

Bill

CERTIFIED METROLONICS TRACEABLE

** Free copy of USAF Specification Bulletin 520 will be provided upon request.*

METROLONICS, INC.

Dept. 52, 2201 N. Hollywood Way, Burbank, Calif.

ASQC Announces

ADVANCEMENTS TO THE GRADE OF SENIOR MEMBER

(as of July 31, 1960)

ALLINGER, WARREN C., Louisville, Ky.
BLOOMBERG, ARTHUR, New York, N. Y.
BRANDT, CLINTON H., Norman, Okla.
CALHOUN, FOREST L., So. Pasadena, Cal.
CHOOK, PAUL H., Forest Hills, N. Y.
CORBETT, E. W., Belleville, Ill.
DUVAL, STEVEN M., Albuquerque, N. M.
ECKERT, JOSEPH N., Fords, N. J.
HEHNER, HARRY O., St. Louis, Mo.
HEMMERLE, HARRY J., Center Valley, Pa.
KOEHLER, TRUMAN L., New Brunswick, N. J.
KRAL, OTTO A., St. Paul, Minn.
LAMKIN, GEORGE F., Maitland, Fla.
LEVENBACH, GEORGE J., New Providence, N. J.
LIPMAN, ARTHUR L., Natick, Mass.
MANNING, THOMAS E., Charles City, Iowa
MC CORMICK, CLIFFORD E. JR., Ft. Worth, Texas
MOSCINSKI, MICHAEL, Latham, N. Y.
NEISER, DONALD L., York, Pa.
NORWICK, BRAHAM, New York, N. Y.
PINTO, DANIEL, Poughkeepsie, N. Y.
POLLARD, JOHN W., Attleboro, Mass.
PRIDDY, JEAN E., Dallas, Texas
PRINCE, HERBERT M., Keokuk, Iowa
RIDGWAY, VIRGIL A., Oklahoma City, Okla.
RINEHART, VENE E., Westfield, N. J.
RIORDAN, FRANK S. JR., Pensacola, Fla.
SMITH, WILLIAM E., Dayton, Ohio
VAN DER REYDEN, DIRK, St. Louis, Mo.
WHEELER, JAMES, Canton, Ga.

ADMISSIONS TO GRADE OF MEMBER

(as of July 1, 1960)

(Continued from September issue)

STEVENS, WILBUR J., Seattle, Wash.
STROM, GERALD R., Lexington, Ky.
SVADEBA, MICHAEL, Detroit, Mich.
URIBE, GABRIEL A., Medellin, Colombia, S.A.
VAN VLEET, J. ROBERT, Reseda, Cal.
VASIL, THOMAS, Mt. Pleasant, Tenn.
WALTON, HAROLD, New York, N.Y.
WARDHOPPER, WILLIAM W., Durham, Ont., Canada
WEAVER, TRUE E., Polk, Ohio
WEIN, MAX, Fremont, Cal.
WELLS, NORRIS B., Columbus, Ohio
WEST, ROBERT D., Torrance, Cal.
WIEBRECHT, WILLIAM C., Buffalo, N.Y.
WILSON, BOB L., Bethune, S. C.
WILSON, FRANK A., Galion, Ohio
WILLIAMS, RAY S., Orrville, Ohio
WILSON, HENRY C., Falls Church, Va.
WIRTH, RICHARD L., Wickliffe, Ohio

ADMISSION TO THE GRADE OF ASSOCIATE MEMBER

(as of July 1, 1960)

ANDREWS, WILLIAM W., Waltham, Mass.
BIGLEY, PAUL B., Marion, Ohio
CHALLIS, HAROLD G., London, Ont., Canada
ETTER, RAYMOND T., San Francisco, Calif.
FINLEY, LESTER G., Galion, Ohio
FORGIE, ROBERT D., Cleveland, Ohio
HOWARD, DANIEL M., Upper Sandusky, Ohio
HUMPHREY, WILLIAM D., Loudon, Tenn.
KAIB, GEORGE N., Long Beach, Calif.
KIPLINGER, DAVID F., Detroit, Mich.
KISSEL, M. M., Galion, Ohio
KREHBIEL, WILLIAM R., Richland, Wash.
LOMBARDO, JOSEPH, Shillington, Pa.
MCKENNA, MELVIN E., Naperville, Ill.
MOFFITT, ROBERT B., Oconto Falls, Wis.
NIJAK, GERALD V., South Bend, Ind.
RIBERA, RAFAEL D., Galion, Ohio
SANDQUIST, WALLACE L., Galion, Ohio
SIEGENTHALER, CLINE, Brunswick, Ohio
SMITH, DANIEL, New York, N. Y.
SMITH, PAUL D., Naugatuck, Conn.
SNARE, PAUL A., Martel, Ohio
STONICK, ROBERT J., Cleveland, Ohio
TURNBULL, WILLIAM R., Galion, Ohio
WALLACE, JAY C., Hawthorne, Calif.
WELLS, WILLIAM E., Noroton Heights, Conn.
WILLIAMS, CURTIS A., Lenoir City, Tenn.
WILSON, FREDERICK T. JR., Livonia, Mich.

STUDENT ENROLMENTS

(as of July 1, 1960)

ROCKWELL, ROLAND E., W. Lafayette, Ind.

JONES & LAMSON
OPTICAL COMPARATORS

the man who needs
a new machine tool is
already paying for it

J & L Optical Comparator is a production tool

At John Hassall, Inc., Westbury, L. I., nails, screws, rivets, fasteners, and other small parts are "Job-Designed" to satisfy the customer whose requirements cannot be adequately met by the standard item.

Rigid AN (military) specicfiations are strictly adhered to whenever required. In all cases, the Jones and Lamson Optical Comparator has become an almost indispensable production tool.

In the cold heading process used at Hassall, the J & L Comparator acts as a monitor for controlling the essentials of the production process. *Tools* for manufacture of dies are checked for proper cutting edge and angle. *The dies* themselves are checked for cavity contour and angle by taking plastic impressions. *Finished parts*, accurately magnified 10 times under the critical eye of the Comparator, are checked at a glance for tolerances. But, even more importantly, this inspection gives essential information as to when and where dies may be worn, or where other areas of the *manufacturing process* should be changed. How easy it is for production control and tolerance requirements to be maintained!

J & L Comparators, featuring magnifications up to 250X are ready to go to work for you. Write for literature. Jones & Lamson Machine Company, 510 Clinton St., Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

What's New?

ROY A. WYLIE, *Editor*
Ampex Corporation

P-10-3—A new training microscope which permits both instructor and trainee to examine a specimen at the same time, has been developed by Bausch & Lomb. The new instrument answers a widespread need for a quick, yet accurate means of training a new employee. The components of the new unit include two standard Bausch & Lomb StereoZoom microscopes and two accessories: a 0.5 x lens attachment for greater working distance and a vertical illuminator, which acts as a beam splitter so both viewers see the same field with equal clarity. The continuous range of power featured in all Bausch & Lomb StereoZoom microscopes, provides maximum balance of magnification. Each microscope can be used independently, or, in a matter of minutes, can be assembled into the teaching unit with common attachments. Both instructor and trainee can view the specimen or production part simultaneously, the trainee seeing specific detail the moment it is described. In addition, the new employee learns how to use the instrument more quickly and accurately, since the instructor can observe the trainee at work and correct errors immediately.

* * *

P-10-1—The Mueller 300 series test indicators are available in 0.001 inch graduations (subdivided in 0.0005 by a dot), and also in 0.0001 graduations. They are also available in milimeter divisions. Movement of the indicator is always clockwise when changing direction of pressure on the contact point. The contact point will not slip, operates in a 186 degree arc, and is available in carbide and hardened tool steel, threaded for interchangeability. Indicators are ball bearing, have no reversing level. The mechanism is geared for extreme sensitivity. Measuring pressure is less than 15 grams, measuring range of the 0.001 indicator is 0.040 inches and the range of the 0.0001 is 0.008 inches.

* * *

P-10-4—A new digital direct reading frequency meter has been developed by The Narda Microwave Corp. A rapid, precise reading can be obtained at a glance by even an inexperienced operator. Because the tuning rate is linear with frequency, the new meters are readily adaptable to remote indication. They may be panel-mounted for system applications. The high Q cavities are precision-bored, and coupled to the narrow wall of a section of waveguide. Design is such that the unit is electrically equivalent to a straight section of waveguide when detuned (VSWR = 1.05 except at resonance). At resonance, a small amount of power is reflected and there is a dip in the transmitted power. This dip is at least 10 percent over the frequency range and there are no unwanted resonances. The mechanism is housed, along with the cavity, in a casting which also provides support for the entire frequency meter. The height of the waveguide centerline is compatible with most instrument stands. Three models (838, 839 and 840) are available for X-, KU, and K-bands, respectively, and are priced at $195, $250 and $275.

* * *

P-10-6—Tektronix, Inc. has introduced a new transistorized, battery-operated, portable, type 321 Oscilloscope. The oscilloscope is a high-performance, light weight instrument in the dc-to-5 mc range and operates on batteries, on the dc power systems of airplanes, boats, autos and trucks or on any standard ac system. Operating temperature range from preliminary tests indicates optimum performance and reliability from 30 degrees to 120 degrees F and at altitudes to 20,000 feet. Weight is 13½ pounds, without batteries, less than 17 pounds with batteries installed in the internal battery case. Size is 8¾ inches high by 5¾ inches wide by 16 inches deep. Price is $785 without batteries.

P-10-5—A new dial indicator collet developed by Unigage Corporation simplifies mounting of dial indicators in fixture gaging, special gages, and instruments. The collet provides uniform pressure distribution to eliminate the possibility of binding the indicator spindle. The dial indicator is easily inserted into the collet and adjusted. The collet fits all dial indicators of the American Gage Design (AGD) specifications. Price is $3.75 each.

* * *

P-10-2—A new secondary standard infrared calibration system, providing a versatile means of calibrating test sources of infrared energy, has been introduced by the Electro-Optical Division of the Perkin-Elmer Corporation. The new system provides a simultaneous comparison of IR sources with a secondary standard reference source whose radiation characteristics are accurately known. It operates on an AC null principle by photometrically balancing the radiation from the source being calibrated to that of the standard reference. Calibration over the temperature range 50 degrees C to 600 degrees C is possible. The infrared calibration system can be used to calibrate sources up to 12 inches in diameter and 50 pounds in weight. It is designed to test sources having aperture sizes from 0.0087 inches to 0.50 inches in diameter. Larger sources and units having smaller apertures can be adapted to the calibration system.

* * *

P-10-7—Medium and high power transistors can now be tested under variable duty cycle conditions with a direct reading instrument designed and manufactured by Baird-Atomic, Inc. The Model NC-1 test set employs a pulse drive technique to make direct measurements of DC parameters at power levels equal to

Correction to 1960-61 Board of Directors

D. G. Browne was incorrectly shown as a Director in the August issue of IQC, page 31. We should have shown:

Allin P. Deacon
Deacon & Associates
Quality Control Consultants
Brantford, Ont.

the maximum dissipation of the transistor. Both the ammeter and voltmeter peak-detect current pulses produce a measure value equivalent to a steady DC current. Readings are registered on 3 inch meters. Power transistor DC current gain, saturation measurements, input and output impedance, leakage current and breakdown voltage can be tested by the NC-1 as well as diode leakage and breakdown measurements. Tests are conducted in common emitter configuration giving readings of V_b, I_b, V_c, and I_c under pulse conditions and giving readings of leakage current and floating potential by standard techniques. Front panel controls include a function selector, which applies the correct currents and voltage to the test transistor without changing connections, and a switch to reverse power supply polarities for testing PNP and NPN transistors.

* * *

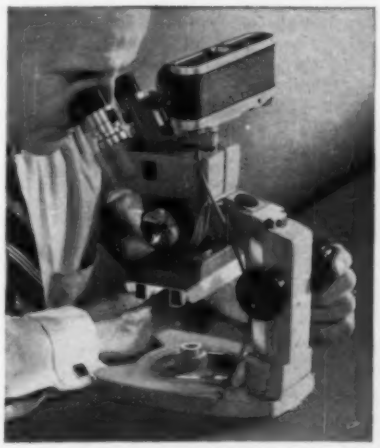
P-10-8—A new, economical, 27 cubic foot reverberation chamber to subject missile and aircraft parts to the extremes of noise they meet in use has been produced by PAM Associates, Inc. The new PAM chamber generates 150 decibels of acoustic power (linear to 156 db) with a wide band noise siren powered by ordinary shop air supply. A separate air supply is also available. The chamber provides random frequency down 5 db at 100 cps and 10 db at 10,000 cps, with instantaneous peaks to 155 db. The rated sound pressure level in the cabinet with no specimen is up to 145 db. The chamber requires 60 cfm of air at 30 psi pressure, has a usable test volume of 40 percent and the sinusoidal input harmonic distortion is under 15 percent. Performance meets or exceeds proposed military specifications for electronic systems internally mounted in jets or missiles. Price of the chamber is $9,950. It measures 4 feet 3 inches wide and 5 feet 4 inches deep and 7 feet 6 inches high.

* * *

P-10-10—Model 851 Programmed Calibration Reference Supply delivers preselected precise calibration voltages over the range 0-10 volts from a constant impedance output of only 10 ohms. Absolute accuracy is better than 0.01 percent for line voltage variations of ± 10 percent over the temperature range from 40 degrees F to 125 degrees F. Tracking accuracy is better than 0.005 percent. The chopper stabilized supply maintains a 30 day stability of better than 0.005 percent. Selection of 10 programmed voltages is by mercury contactors with panel pushbutton or remote selection available. Also available is auxiliary automatic sequence scanning, with variable scan rate. Price is approximately $2,000.

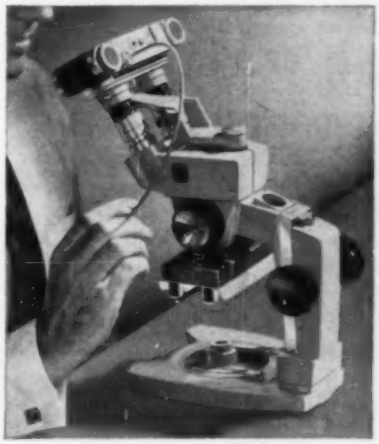
AO Offers Low-Cost Stereophotomicrography

. . . in just three easy steps

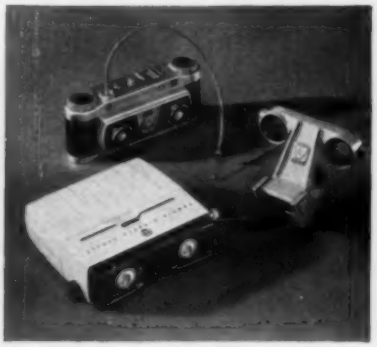


1 SET the focusing adjustment on your AO Spencer Cycloptic Stereoscopic Microscope, to bring specimen into sharp focus. Camera is mounted directly to Cycloptic...out of the way...ready for instant use.

2 SWING the mounted 35 mm Graflex Stereocamera into position over eyepieces. Designed exclusively for Cycloptic, special compensating prisms in adapter unit render camera parfocal with microscopes' optical system. Set camera for bulb exposure. No further adjustment is necessary.



3 SNAP shutter with cable release. You photograph the sharp three-dimensional image exactly as you saw it. Your film processor will supply stereo mounted photographs. Now you have permanent, three-dimensional photomicrographs, in black-and-white or color, for future reference.



The full-size Graflex Stereoviewer, with built-in light source, completes this easy-to-use 3-D photo package. You can review your findings over and over again...anytime ...anywhere. Here is everything you need for three-dimensional photomicrography... unique...easy-to-use. Available only from American Optical.

Ask your AO Sales Representative or write:

American Optical Company

INSTRUMENT DIVISION, BUFFALO 15, NEW YORK

Dept. K248

☐ Please send full information on AO Spencer 637 Stereocamera attachment.

☐ Also include information on AO Spencer Cycloptic Stereoscopic Microscopes.

Name_____

Address_____

City_____ Zone____ State____

P-10-9—A completely new design of the stroboscopic tachometer sold for many years under the trade name Strobotac has been announced by the General Radio Company. The new Model 1531-A features a fundamental speed (flashing-rate) range of 110 to 25,000 rpm and brilliant white-light flashes with extremely short duration—1 to 6 microseconds — permitting fast action to be stopped. A specially developed strobotron lamp produces the high intensity flashes with peaks of 0.21, 1.2 and 4.2 million candle-power on three speed ranges; high (4000-25,000), medium (670-4170) and low (110-690). The single flash-rate peak is 7 million-candlepower. An electron pulse generator controls the flashing rate. The light is housed in a parabolic reflector assembly, the reflector swiveling around the lamp so that the light can be directed toward practically any point. The extremely short flash will freeze high-speed motion of such rotating and reciprocating machine elements as cams, pulleys, governors, gears, fans, linkages, pawls, sprockets and chains. Since no mechanical contact is required with the machine to be measured, no power is absorbed and and machine's operation is not affected. Speeds of up to 250,000 per minute also can be measured by using flashing rates that are submultiples of the speed to be measured. The instrument can be calibrated by making two screw driver adjustments against power-line frequency. Accuracy of the new Strobatac is ± 1 percent of the dial reading after calibration on the middle range. The case is 6¼ inches by 5½ inches by 8¾ inches and overall weight is 7⅛ pounds. Price is $260.

* * *

P-10-11—A new low cost, light sensing electronic inspection system for detecting and removing a great variety of imperfect items from production conveyor lines has been developed by Atronic Products Inc. This equipment can detect imperfections that create as small as 3 percent variation in light reflected or transmitted from the items being inspected. Usable with conveyor belts up to 10 feet wide and at speeds up to 600 feet a minute, it is adaptable to a great variety of processes and production lines in the plastics, metals, glass, food processing and textile fields. The Atronic Inspector provides "eyes" and "hands" that substitute for inspectors. Any material flaw that causes a 3 percent or greater change in light reflected from its surface or transmitted through the material can be detected by the Atronic Inspector. Examples of these material flaws would be rough surfaces on plated parts, surface holes, stains and gas inclusions. Typical applications include: detecting flaws in sheet metals and sheet plastics; detecting and removing discolored food products from processing lines; and marking stains and faulty weaving in textile products. The Atronic Inspector operates by detecting differences in light intensity between the flaw and its surrounding area. The system consists of an illumination source over the conveyor, an optical scanner which rapidly gathers information on light intensity differences, a data processor which analyzes the information, a control panel and a power supply. The actuating device for removing or marking the flaw is especially designed for each application.

* * *

P-10-12—Automatic micrometer measurements to 10 millionths of an inch can be taken by an operator located far away from the actual point of measurement with the new Carson-Dice Remote-Mike. It consists of a highly accurate micrometer head operating on the screw thread principle, an operator's electronic control console, plus connecting cable of any length required. Remote micrometer head exerts negligible pressure on the work. Measuring range is 1 inch. Digital read-out to 10 millionths is displayed on a counter on the operator's console. The head can be remotely zeroed in at any point within its measuring range. Heads may be used singly or in multiple.

* * *

P-10-13—Announcement has been made by Michigan Tool Co. that its versatile low cost #607 bench type roll tester for gears with center distances from 1¾ to 6 inches is now available with a checking recorder as extra equipment. The standard tester, listing at only $750, has a spindle type mounting stud for the master gear. If it is desired to use it as a conventional tester, a set screw locks the stud. The tester will check size, eccentricity and meshing smoothness of either helical or spur gears from 8 to 48P. When used with a dial indicator, deflections are shown in increments of 0.0005 inches.

1960 Shewhart Medal Nominations

Nominations are now being received by the Shewhart Medal Committee for consideration with respect to the Shewhart Medal Award for 1960. Previous Medalists are:

L. E. Simon	—1948	E. G. Olds	—1954
H. F. Dodge	—1949	W. E. Deming	—1955
M. A. Brumbaugh	—1950	M. E. Wescott	—1956
G. D. Edwards	—1951	C. C. Craig	—1957
E. L. Grant	—1952	I. W. Burr	—1958
H. G. Romig	—1953	P. S. Olmstead	—1959

A letter of notification is being sent to all ASQC Section Chairmen. Any member of the Society is privileged to make a nomination for this honor. It is important, however, that any nomination be accompanied by suitable biographical and other information supporting the nomination so that the Committee will be able to give adequate consideration to the qualifications of the nominee.

Nominations may be forwarded to the Shewhart Medal Committee through the Chairman of the local Section, or they may be sent direct with supporting information to the Chairman of the Medal Committee, G. Rupert Gause, Bell Telephone Laboratories, 463 West Street, New York 14, New York. Nominations received by the Medal Committee on or before December 31, 1960, will receive consideration. Ten (10) copies of the letter of nomination and ten (10) copies of the supporting information will be needed for distribution to the Committee.

New Literature Available

L-10-1—The following new and revised publications have just been issued by the National Electrical Manufacturer's Association:

1. AD 1-1960 Adsorption Equipment
2. BC 5-1960 Bituminized Fibre-pipe
3. EI 15-1960 AEIC - EEI - NEMA Standards for Thermal Demand Meters
4. EI 17-1960 AEIC - EEI - NEMA Standards for Watthour Meter Sockets
5. FB 1-1960 Conduit and Cable Fittings and Accessories
6. HT 5-1960 Mild - to - Medium - Strength Carbon Steel Castings for Hydraulic Turbines
7. HU 1-1960 (June 1960) Industrial Heating Units and Devices
8. HV 1-1960 Summary of Characteristics of Apparatus Insulators
9. SG 2-1960 High-voltage Fuses
10. SK 50-1960 EIA-NEMA Standards for Color Coding Semiconductor Devices (Diodes and Rectifiers)

★ ★ ★

L-10-2—Bulletin 4-1 has been issued by Consolidated Vacuum Corporation covering their vacuum pumping equipment. Systems are described for a wide variety of processing applications, including leak detection by the mass spectrometer principle.

★ ★ ★

L-10-3—Ultrasonic flaw detection is the subject of the new Bulletin T200, offered by Branson Instruments, Inc. The booklet includes operation, techniques, and a list of specifications for the Sonoray 5 flaw detector.

★ ★ ★

L-10-4—Keuffel & Esser Co. has announced publication of a new brochure which describes the components and operation of its new Optical Leveling Kit. The booklet contains full data on industrial alignment problems and solutions, including foundation or bed leveling, profiling, differential leveling and checking movement of equipment.

★ ★ ★

L-10-5—A technical bulletin just released by Dynatron Laboratories describes the operation of a Transistor Checker which permits direct reading of Beta, ICO, Inverted Beta, and IEO. A discussion is included regarding the testing of these important DC parameters.

★ ★ ★

L-10-6—A complete line of Hunter Mechanical Force Gages is described in detail in Bulletin 750/FG just published by the Hunter Spring Co.

★ ★ ★

L-10-7—The latest data on environmental testing and other applications for controlled atmospheric conditions is the subject of a new 32 page Brochure #600 offered by Webber Manufacturing Co., Inc. The bulletin includes a pictorial color chart summarizing latest known data on specific weight, pressure, acceleration of gravity, and molecular weight at the various altitudes up to 2 million feet. Other charts give technical information on atmosphere, temperature and humidity.

★ ★ ★

L-10-8—An eight page article entitled "Achieving Reliability Through Integrated Quality Control," designated PIB-50, has been made available by the General Electric Co. It outlines a philosophy of integrated quality control and applies this philosophy to the problems of achieving reliability in missile work.

★ ★ ★

L-10-9—*Edgegraphing*, a new technique for hand analysis of complex engineering data in 10, 20, or more variables, is included in 16 pages of technical literature offered by the Statistical Engineering Institute.

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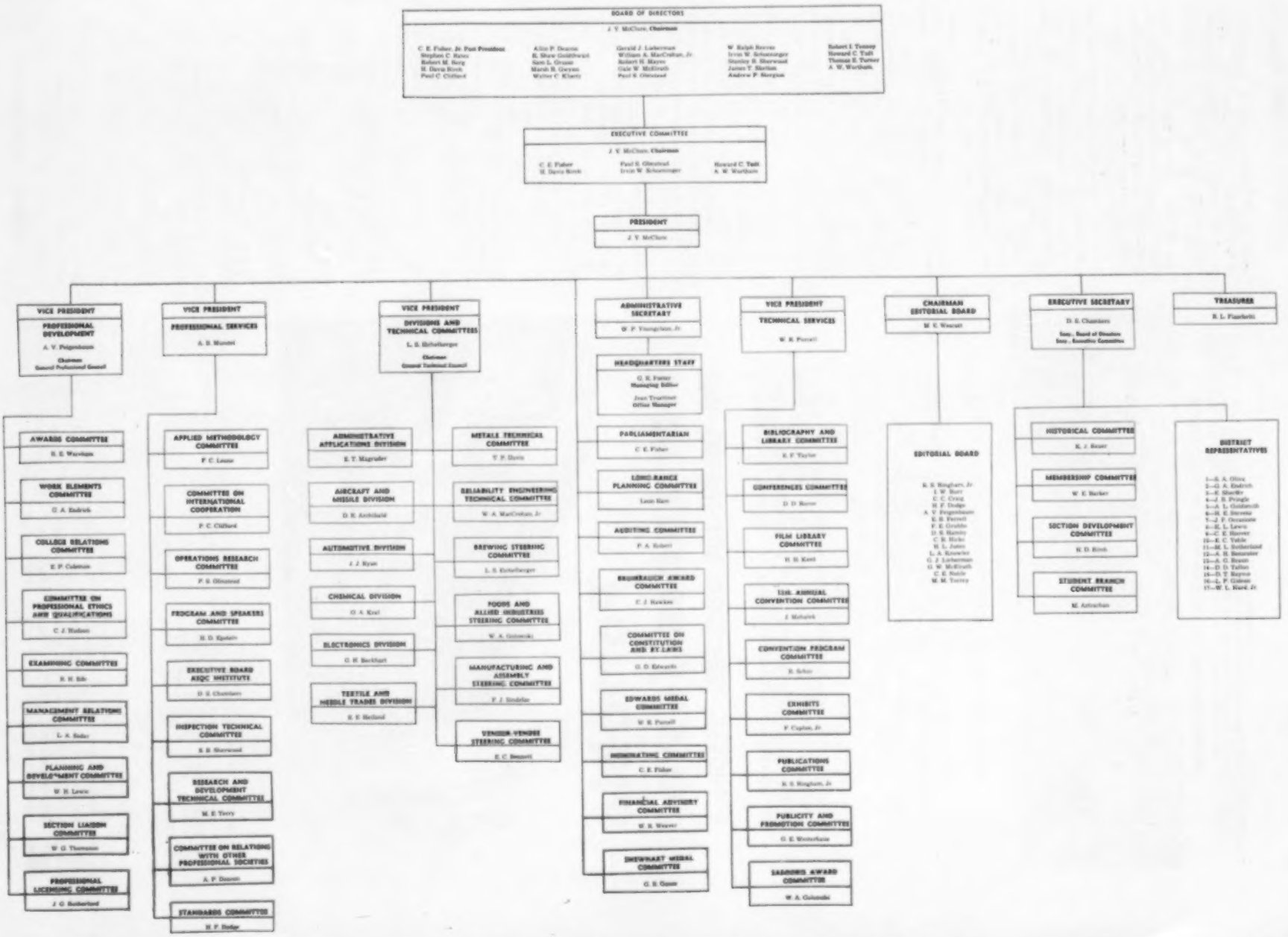
American Society for Quality Control, Inc.— Organization Chart for 1960-61



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section briefs

ALLENTOWN-BETHLEHEM . . . Although there were no formal meetings this summer, the executive committee has been active.

The reorganization meeting was held at the home of Ken Stephens complete with barbecues and all trimmings! The new officers are — chairman — Dick Zwickl, Western Electric, Allentown, Pa.; vice chairman — Tom Kochie, Atlas Powder, Tamaqua, Pa.; secretary — Harry Spaulding, Dixie Cup, Easton, Pa., and treasurer — Dan Scrobe, Western Electric, Laureldale, Pa.

The program for 1960-61 has been well developed by program chairman Marty Wohlbruck, with all meeting dates and speakers established.

The formation of a Reading, Pa., sub-section — in the talking stage for quite some time — became a reality with the election of officers. They are chairman — Jim Caton, Western Electric, Laureldale, Pa.; vice chairman — LeRoy Duncan, Reading Tube, Reading, Pa.; secretary — Marino Ruggere, Signal Corps, USA, Western Electric, Laureldale, Pa.; and treasurer — Dan Scrobe, Western Electric, Laureldale, Pa. Committees and key men have been appointed and are working toward a highly successful first year. Good luck to you, Reading!

David F. Roberts

BATTLE CREEK-KALAMAZOO . . . In July, the new officers met at the Michigan Carton Co., Battle Creek, Mich., to continue plans for the coming season. Plans include a fall course in basic QC methods to be held in the Charlotte, Mich., high school.

The annual management Night dinner meeting will be held at Schulers Inn, Marshall, Mich., on Oct. 20. Speaker is Sydney M. S. Dunn, senior engineer, A. T. Kearney Co. Mr. Dunn's topic is entitled "Management Needs Quality Control — Why?" In addition to Mr. Dunn's six years in consulting practice, he has spent 15 years in industry in both line and staff capacities, both in the United States and Canada, and for some years was a member of the American Statistical Association. He is a current lecturer at Executive Management Seminars for the University of Chicago.

Peter F. Koets

BIRMINGHAM . . . On July 20, the Birmingham section planning committee planned meetings for the coming year, and passed on four new-member applications. The section has processed nine new-member applications.

The Annual QC Conference on Oct. 13-14, at the University of Alabama, Tuscaloosa, Ala., will include two luncheons and a banquet. Speakers are Howard Jones, University of Chicago; F. S. Riordan, Chemstrand Corp.; Wade R. Weaver, Republic Steel Corp.; George Henderson, Redstone Arsenal, William Lane, Auburn University, and William G. Masser, General Electric Co.

Arthur E. Raeuber

BOSTON . . . The section will open a basic QC course Oct. 24, at the Wentworth Institute. The course will continue for six consecutive Tuesday evening sessions.

A course in practical production reliability will be opened Oct. 3, to continue for five consecutive Monday evenings. Course instructor will be Dorian Shainin of Rath and Strong Consultants.

This season, the pre-meeting sessions will be in the form of workshops which will include all of the various divisions of ASQC. These workshops will be directed by Robert G. Fitzgibbons, Raytheon Co., Wayland, Labs.

The Boston section is a co-sponsor of the New England Regional Conference to be held in Worcester on Oct. 20-22.

H. L. Keefe

CHICAGO . . . The first general meeting Sept. 7 was — as it has been in the past — the start of another season filled with informative, interesting and sociable general meetings; educational programs; increased membership, and as always, progressive, capable section officers.

Section officers for the 1960-61 season are chairman — Robert W. Majeski, Victor Adding Machine Co.; vice chairman, section affairs — Lawrence R. Stickler, R. R. Donnelly & Sons; vice chairman, program — Frank W. Berman, Reynolds Metals Co.; vice chairman, membership — Mervin W. Fisher, Advance Transformer Co.; secretary — Samuel P. Richards, Hammond Organ Co., and treasurer — John Louer, Artag Plastics. Section directors are Mae Goodwin Tarver, Continental Can Co., Inc.; Charles W. Matz, Commonwealth Edison Co., and Howard L. Jones, University of Chicago.

As part of its expanding service to the QC field, the Chicago section sponsored a "Symposium on Customer Complaints," on July 23. Marvin Claeys, QC superintendent, United Air Lines, was chairman. Irving W. Burr, Purdue University, acted as discussion leader.

Attendance was by invitation and limited to 10 diversified industries. Participants cross-fertilized and discussed complaint handling from top to bottom. Everyone left with many ideas for immediate investigation. We are hoping that there will be more of these in the future.

The basic statistical QC course sponsored by the Chicago section got off to an excellent start Sept 13. Both attendance and interest are high.

The course is being conducted at the University of Illinois, Navy Pier branch, by Gilbert Sorbor, QC engineering chief at Western Electric.

Mr. Sorbor, a member of the Chicago section, has taught similar courses at other schools, most recently at Northwestern University.

John Dittrich

CINCINNATI . . . The Cincinnati section will be looking forward to meeting with Mel Snow, the speaker for the Oct. 19 technical meeting. Mel is a former member of the Cincinnati section and has many friends in this area. His presentation will be "Fundamentals of Quality Control with Case Histories."

Rudy Gruber, program chairman, has arranged for a plant visit to the Interchemical Printing Ink Co., for

The Unsung Heros

In this issue you will notice that we have included the name of each reporter in Section Briefs, immediately following the section write-up.

These are the men who provide us with the news about your section each month. Their task is relatively thankless and somewhat monumental—that monthly deadline sneaks up all too frequently.

Crediting the reporters with a by-line is the least we can do to recognize their excellent service.

G. R. F.

Wednesday, Oct. 5. This visit will be a joint meeting with the Hamilton-Middletown section.

During July the section completed the program for the 1960-61 year. The program, which is ready for the printer, will be published jointly with the Hamilton-Middletown section.

Also during July, the section reviewed the past year's activities to prepare items for the scrap book.

J. A. Eckles

COLUMBUS . . . The October meeting, a plant tour of the Mead Paper Co., Chillicothe, Ohio, should be an interesting experience for section members. The plant makes paper and paper products from basic raw materials.

George Arris

DALLAS-FORT WORTH . . . A good group of members and guests enjoyed a very interesting tour of the Fort Worth Star-Telegram on July 21. For many, this was the first time to see the innerworkings of newspaper publishing. While the tour was scheduled to require 45 minutes, we spent almost two hours following newspaper production from selection of articles, making of matts, operation of presses, preparation for mailing, and loading into trucks. After the tour we were served delicious pie and coffee at the plant's cafeteria.

The quality control manager, Roy W. Burks, explained some of the cost reduction ideas he has been able to install. Some of these ideas have resulted in savings of thousands of dollars. He also described the operation of a new automatic, tape controlled, counter and mailer, which is to be installed soon. This new equipment is also expected to save many thousands of dollars per annum.

We are looking forward to meeting F. C. Lewis from Cook Heat-Treatment Co., Houston, Tex., at our meeting Oct. 20. Mr. Lewis will be the first circuit-speaker of the year.

R. R. Massegee

DELAWARE . . . Our first meeting of the season will mark the Delaware section's 15th Anniversary. In observance of this occasion, we are honoring all past chairmen at our annual Ladies Night program. As in the past, the ladies' dinner will be free.

The after dinner speaker for this event will be Hillman Harris, who is also a past chairman of our section. The title of his talk is "Probability and the Game of Chance." Mr. Hillman recently received high praise for the paper when he presented it at an AMA Seminar in Boston. We are all looking forward to hearing his talk (and will temper our associations with games of chance in the interim).

This is the first in a series of dynamic programs which the executive committee has planned after meeting diligently throughout the summer months.

Marvin C. Thompson, Jr.

ERIE . . . Officers for the 1960-61 season are chairman — J. S. Zahniser, Talon, Inc., Meadville, Pa.; vice chairman — R. J. Greaney, General Electric Co., Erie, Pa., and secretary-treasurer — Gerald Munson, Saegertown Components, Saegertown, Pa.

The new officers met at the home of the past president Richard Love of the Erie Resistor Co., for a planning meeting in late June. At this time the charter and ASQC records were turned over to the new officers.

Andy Downer of Talon, Inc., has agreed to accept the job of program chairman. Andy was active a few years ago in the New Haven, Conn., section, and a member of their executive committee. Details of this year's program are not available at this time, but the program, for the most part, will be a basic training course in QC with a mixture of advanced and special subjects.

Most of the meetings are planned for Erie, with several in communities within a radius of 40 miles, such as Meadville or Corry, Pa.

G. Whitesmith

EVANSVILLE-OWENSBORO . . . Though regular section meetings are not held during summer months, the executive committee has been busy planning a very promising program for the year. Mel Schwartz and his program committee have obtained an excellent group of speakers. Included in the program are two plant tours. The final meeting will be a Ladies Night. The speaker for that meeting will be R. Henry, who will present "Personality Through Handwriting." Mr. Henry has a reputation for keeping audiences charmed and apprehensive at the same time that he shows how handwriting really reveals.

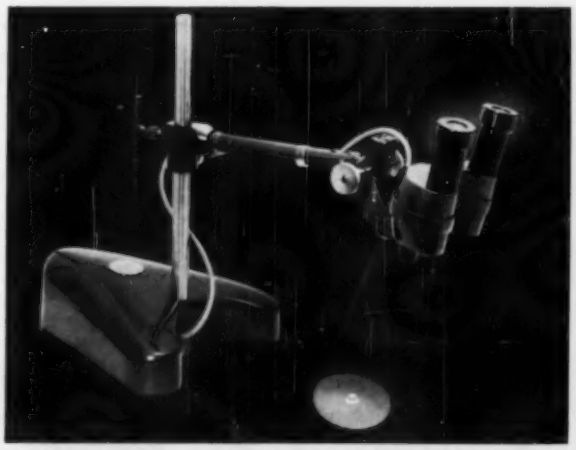
On Oct. 18, J. E. Anderson, milling engineer and statistician for Inglehart Bros., Jello Division of General Foods, will speak on "Practical Application of Statistical QC."

Wane VerWayne

GREATER DETROIT . . . The section sponsored a one day course in EVOP June 25. Morris Lightstone of Chrysler Corp., was course director. Brant Bonner of Dow Chemical Co., gave a two hour lecture in the morning and another in the afternoon. Forty persons registered for this course, including a young engineer from South Africa, Sterling Spencer.

The first board meeting of the new officers was held July 13, in the new Dearborn Center, formerly the Henry Ford estate, which is now operated by the University of Michigan. The Fifteenth Annual Forum, which was held Sept. 10 in Ann Arbor, Mich., was discussed during the greater part of the evening.

International Night will be held Oct. 3. A dinner meeting, it will be co-sponsored by the Windsor and Greater Detroit sections. Howard Sprengel, chief inspector of the Detroit Ordnance District, will present a



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film on *Industrial Progress in Japan*, which will concentrate on what has taken place during the last few years. Mr. Sprengel will touch on QC activities in numerous other countries, which he covered on his recent tour.

Frances D. Huntington

HARRISBURG . . . On July 12, an executive committee meeting was held at Bendix Corp., York, Pa. Chairman Herman Singer reported that the education committee had arranged to conduct the advanced course at the Dental Supply Co., York, Pa. The intermediate course will be conducted at the Lancaster plant of Schick, Inc.

Arrangements chairman K. Gainer has confirmed the report that the meeting in Harrisburg will be conducted at the Castigilia's.

Ann Englehart has been appointed reporter for the coming year. Harold Reehling, program, and Harry Oyler, publicity chairman, both have their committees and plans well under way.

On Oct. 5, the new season will be opened at the Castigilia Restaurant in Harrisburg, Pa. Ervin F. Taylor, Martin Co., Baltimore, Md., will be the guest speaker. His topic will be "Frequency Distribution Analysis Sheet." The technical use of the sheet will be discussed, followed by a workshop which will consider a specific problem.

Ann Englehart

HARTFORD . . . During an executive meeting at the home of Al Aubin on July 12, it was voted to schedule eight meetings this season.

The Hartford section will again sponsor a series of educational short courses — basic QC, advanced QC, theory of gaging, and statistical engineering. The courses will commence late in October.

The Oct. 11 meeting will be Ladies Night. C. W. Carter will try to sell the [illegible] one spends his time in the control of quality.

Lawrence Sespaniak

KANSAS CITY . . . Officers for the 1960-61 season are chairman — Cliff Cutler, Hallmark Cards; vice chairman — V. J. Smeltzer, Bendix Aviation Corp.; secretary — Wilfred Beumer, Wilcox Electric Co., and treasurer — Don M. Thomas, Westinghouse Electric Corp.

An executive committee meeting for the development of the 1960-61 program was held July 21. The program will be announced as arrangements are completed.

Afton Taylor

LIMA . . . During July, QC managers of the individual plants in the Lima section presented certificates for the completion of the intermediate statistical QC and measurements courses.

Ex-Cell-O Corp., Lima, Ohio, recently gave a dinner for all ASQC members of their corporation. Members who had satisfactorily completed the aforementioned courses were guests of honor.

E. K. Anderson

MID-HUDSON . . . On Oct. 4, the section will tour the DuPont Fabric Plant in Newburg, N.Y. Employees will explain the various methods of processing the fabric and means of controlling these processes.

Though this is the first plant tour of this season, plans are being made to conduct additional tours so members might become better acquainted with the various types of quality problems confronting businesses in our area.

E. L. Leadbitter

MILWAUKEE . . . The June and July executive committee meetings resulted in the selection of very capable

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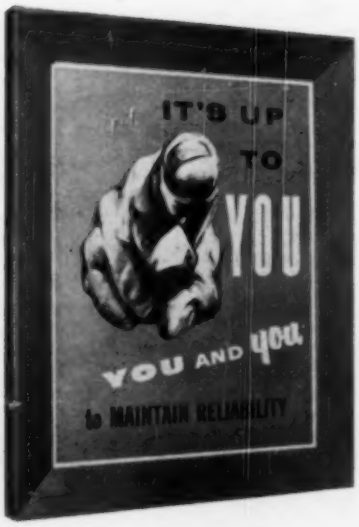

committee chairmen to help carry the load for the coming year.

The June meeting was called by George I. Craycraft, junior past chairman, and was held at the Milwaukee Inn. Prior to our meeting an excellent dinner was enjoyed by everyone in the main dining room, after which the business meeting was held in the Tea House. The main objectives were to make the transition from the old officers to the new officers and to start the organization of the various committees.

The July executive committee meeting was called to order by our new chairman, Larry Neuman. It was reported that nearly all committee positions were filled and the program for the coming year was well on its way. As in the past, the Milwaukee section will have training sessions prior to the regular monthly meetings.

A program of inspection techniques and gaging is being considered. This program will be run concurrently with the training sessions.

D. G. Schroeder

MONTREAL . . . On Oct. 22, the Montreal section will hold its annual All Day Forum. Under the chairmanship of S. L. Humphries of Aviation Electric, the All Day Forum committee has been busy throughout the summer preparing the agenda. It will take place at the Ecole Polytechnique at the University of Montreal. Many prominent speakers on QC have arranged to attend the Forum. It is expected that there will be about 300 people in attendance, representing 66 industries. "The Control of Quality" has been chosen as the theme this year. The luncheon address will be given by S. M. Finlayson, the president of Canadian Marconi Co.

T. F. Waterston

MUNCIE . . . Our October meeting will be a plant tour of the new Fisher Body plant at Marion, Ind. Many new members requested this tour. A short meeting will be held with the staff of the Fisher Body QC department.

C. B. Johnson

NORTHEAST TENNESSEE . . . Though general membership meetings have not been held during the summer, officers and directors have been busy planning the year's program, which has been completed.

The section has planned many educational and social programs to supplement the general membership meetings. A strong membership drive has also been planned.

The section chairman has sent a personal letter to each section member, urging him to expend every effort to assist in the planned program of activities.

The chairman elect has been appointed Saddoris Award chairman. He has also written to each member to remind them of their quota of Saddoris points.

All section members are determined that East Tennessee will win the Saddoris Award during the coming year.

M. Gomez

PARKERSBURG . . . The executive committee meeting was held Aug. 1, at Howard Johnson's Restaurant, Route 21, between Parkersburg and Vienna. After a wonderful dinner, the scheduling of future meetings was discussed.

The Parkersburg section will be publicized on radio and television during the coming season. Joint meetings have been planned with other Societies.

Robert R. Stewart

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PENSACOLA-MOBILE . . . With the approach of the fall season, which means the resumption of ASQC meetings, this section is quite happy to observe all newly appointed committee chairmen and assistants actively engaged in finalizing plans for the 1960-61 year. The word from Pensacola, Fla., home of this year's program chairman — Lloyd Henry of the Chemstrand Corp. — is that speakers have been scheduled and a section program is at the printers. Everyone who has seen the program for the coming year is enthused.

Plans for a fall QC Conference are now being made. This conference will be the Eighth Southeastern QC Conference and will be jointly sponsored by the Birmingham section, the University of Alabama, and our section. As in the past, this conference will be held to provide a meeting place where people sharing similar interests in QC can discuss problems and acquire new ideas in an atmosphere conducive to learning.

Walter D. Nencka

PHOENIX . . . Les Gideon of Hughes Aircraft Co., who is District 16 representative and Los Angeles Saddoris Award chairman, will speak on "Video Sonic Instruction," at the Ramada Inn Oct. 19. Mr. Gideon has had wide experience in ASQC educational activities and we therefore urge all members to attend this meeting. Mr. Gideon is going to cover the latest methods of on-the-job training in his presentation of "Video Sonic Instruction."

F. Lauerman

PITTSBURGH . . . At an executive committee meeting on July 20, it was decided to award Dr. E. G. Olds an honorary section membership at the first section meeting of the season. From the discussion of the plans regarding publicity, programs, membership and education, a well-rounded active year is in the making!

Arrangements are being made to get announcements of impending meetings aired on two radio stations. The program incudes two field trips, four technical sessions, a joint meeting with the American Statistical Association, a local speaker, and perhaps best of all, a Ladies Night program.

Present indications are that the 1960-61 season will be packed with activity for all members and guests.

Chester R. Smith

PITTSFIELD . . . The executive committee met July 20 at the Stanley Club in Pittsfield. The meeting was called to order by William O. Noble, chairman. At this meeting, the new committee officers accepted the books from the outgoing officers accompanied by some good natured ribbing. During the meeting they settled down to the business of the coming year, and closed with a feeling of "good job, well done."

Howard J. Greenslet

PORTLAND . . . Congratulations have been extended to Herman Karlebach for the paper he presented at the ASQC Convention in San Francisco, Calif. The paper was entitled "The Gage Control Problem and How It was Met."

At the last meeting of the executive committee it was decided that the committee meetings for the coming year would be held in the recreation room of Omark Industries, Inc., McLoughlin Blvd., plant. The committee plans a far more varied program for the coming year and has invited several speakers from other areas to present papers at the meetings. At least one dinner meeting has been planned for the coming year.

Henry T. Blood, QC manager for Omark Industries, Inc., will present a paper of very vital interest Oct. 4. Statistical QC is new in the Portland area, so the number of people working in the field has been quite limited. However, with the increase of new industries, and particularly the electronic industry, there are many positions opening up. Mr. Blood's talk will show the many new possibilities for employment for qualified personnel in quality control.

George Mickel

RHODE ISLAND . . . During the coming year the section will be priviledged to hear such outstanding speakers as Harmon S. Bayer, Charles W. Carter, H. Russell Beatty, Warren R. Purcell, H. D. Voegtlen, and Paul K. Moffat. Our October meeting has been cancelled due to conflicting dates with the 14th New England QC Conference, which will be held in Worcester, Mass., Oct. 19-21, 1960.

Raymond B. Fournier

ROCHESTER . . . In an attempt to get more people to the meetings, the regular monthly meetings are being held as joint meetings with the various sub-groups more often than they have in the past.

The October meeting will be a joint meeting with the technical sub-group and, as in the past, will be a dinner meeting.

Chairman Wilber C. Myers, Delco Appliance Division, General Motors Corp., praised past chairman Carl Jensen, Haloid Xerox, Inc., for his leadership and noted the success of the 16th Annual Conference, which was held last year at the University of Rochester.

Officers for the 1960-61 season, in addition to Mr. Myers, are vice chairman — Thomas J. Soebbing, Eastman Kodak Co.; secretary — John H. Baker, Eastman Kodak Co., and treasurer — Karl Speitel, Bausch and Lomb Optical Co.

Albert D. Rickmers

SACRAMENTO . . . "Developing Industry Standards by Statistical Methods," a talk presented by D. H. W. Allan of the Iron and Steel Institute, New York, N.Y., was undoubtedly the "piece de resistance" needed to make the dinner meeting held at Sam's Hofbrau, Sept. 21, a success. As this was the "kick-off" meeting for the

1961 Edwards Medal Nominations

Nominations are now being received by the Edwards Medal Committee for consideration with respect to the Edwards Medal Award for 1961. The First Medalist, for 1960, was Simon Collier.

Any member or group of members of the Society may make a nomination for this honor. It is important, however, that each nomination be accompanied by suitable biographical or other information supporting the nomination so that the Committee will be able to give adequate consideration to the qualifications of the nominee.

Nominations should be sent with supporting information to the Chairman of the Edwards Medal Committee, Warren R. Purcell, Raytheon Manufacturing Co., 429 Watertown St., Newton, Mass. Nominations received by the Medal Committee on or before December 31, 1961, will receive consideration.

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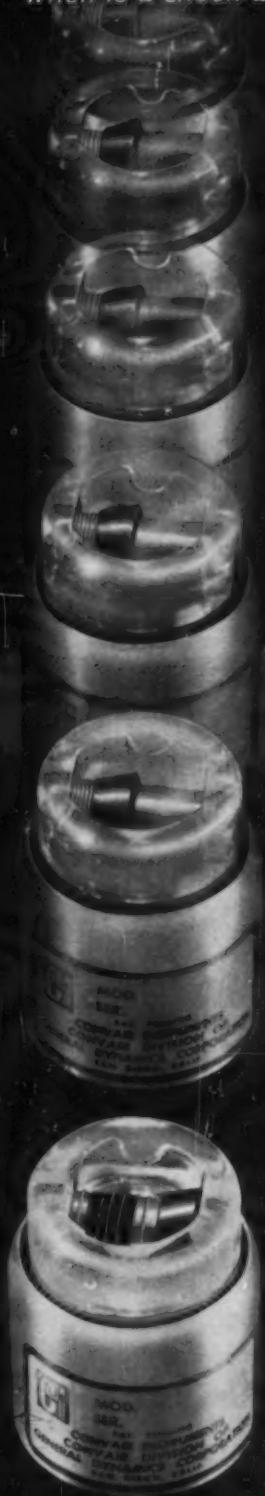

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newly elected officers, it also gave promise of "things to come."

New officers are chairman, J. F. Self; secretary, E. D. Shafer; and treasurer, P. S. Reis of Aerojet-General's Solid Rocket plant, and vice chairman, J. P. Sullivan, McClellan AFB, Calif.

M. K. Walker

ST. CHARLES . . . The St. Charles section officers held their second executive meeting at the home of chairman Albert Stoltz in Glenn Ellyn on July 28. Business included final arrangements for the Annual Management Seminar and the planning of coming events. Robert Fischer, who has been handling the Management Seminar, reported that more than 500 invitations had been mailed.

Robert Mink, our education chairman, reported that at least two education courses were being planned for this fall.

David Fyfee, our vice chairman, reported that our program for the coming year was completed and confirmed. The other officers present outlined their plans for the coming year and from the enthusiasm displayed at this meeting, a good year is in the offering.

E. Ellis Elder

ST. LOUIS . . . Section chairman Harvey Barnett has received acceptances for all committee chairmanships. This group is now actively planning the year's activities.

The October meeting will feature a talk on "Quality Control in the Stock Market," by Mr. X. The identity of Mr. X is top secret and will not be released until he is introduced on Oct. 21.

W. W. Paris

ST. PETERSBURG-TAMPA . . . On July 14, the section held a Fellowship Night in the exquisite gardens of the "Tropic Lounge" night club at St. Petersburg, Fla., in honor of the outgoing and incoming section officers. Prospective members were invited to attend. A good time was had by the 40 attendees.

The local membership drive, headed by chairman Harry Kraff, is in full swing.

H. L. Goldberg

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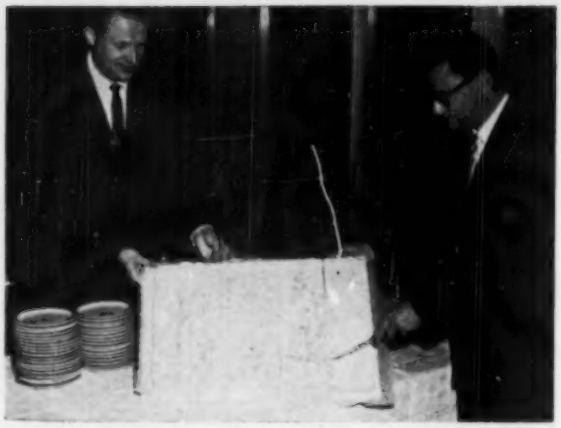

Lyle Connell, section chairman, and Stan Hotchner, outgoing section chairman, served cake in observance of the 10th Anniversary of the San Francisco section.

SAN DIEGO . . . The section installed its new officers at a dinner dance at the Sands Hotel on July 16. The installation ceremonies were presided over by retiring chairman H. E. Fleming of Rohr Aircraft Corp. Officers installed are chairman — L. I. Medlock, Convair Astronautics; vice chairman — V. J. Scherkenbach, Solar Aircraft Corp.; secretary — S. S. Smith, Convair Astronautics, and treasurer — J. M. Aldrich, Rohr Aircraft Corporation.

The section was honored to have as guests Mr. and Mrs. L. P. Gideon from our neighboring section, Los Angeles. Lester is our District 16 representative.

Arrangements, including excellent buffet, beautiful decorations, and good music for the gala event, were arranged by R. I. DeLong of Convair Astronautics.

A glance at our Section Calendar tells us that our meeting of Oct. 17, will be of vital interest to all members. It will be this section's distinct pleasure to get a first hand understanding of the "Philosophy of Goals" of our society from the ASQC president, J. Y. McClure.

L. I. Frederickson

SAN FRANCISCO . . . John E. Yocum, director of technical services, Bay Area Air Pollution Control District, spoke June 13, on "Bay Area Air Pollution Problems." He discussed the nature and magnitude of air pollution in the Bay area. This meeting was the Tenth Anniversary of the founding of the San Francisco Bay Area section.

A. J. Brown

SOUTH TEXAS . . . Our section features a pre-meeting training session as well as a social prior to our regular dinner meeting. We would like to urge all of our members to take advantage of both of these features this season.

Ed Franklin

SOUTHERN CONNECTICUT . . . Section chairman Howard A. Rosenberg announces that emphasis will be placed on metrology in planning the programs for the year. Keen interest in the subject was borne out by the large attendance at the Seminar on "Product Reli-

ability Through Gaging," held at the University of Bridgeport last March.

Robert E. Kleid

TOLEDO . . . Clifford L. Christensen, chief inspector, and Ward W. Wright, assistant chief inspector, will act as hosts and moderators Oct. 6, during a plant tour of the Dana Corp. These men have been members of the Toledo sections since its inception, and their applications of QC in the Dana plant should be very interesting and educational.

Carwin L. Elwick

UNIVERSITY OF WESTERN ONTARIO . . . On Oct. 19 at 6:30 p.m., Management Night — a joint dinner meeting of the London and Kitchener sections — will be held at Stratford with Jack Symmons, factory manager, Dominion Rubber Co., as keynote speaker.

The Hamilton Forum, an all-day forum on QC, will be held Nov. 5, at McMaster University, Hamilton.

"Cost vs. Quality" will be the topic of a panel discussion to be conducted by Harry McCormack, plant manager, Controls Co., (Can.) Ltd., of the St. Thomas section. Panel members will be selected at the meeting. The dinner meeting will be held at 6:30 p.m., Nov. 9, in London.

William Kloostermen

UTICA . . . At 6:15 p.m., Oct. 20, at the Hotel Hamilton, Gordon H. Beckhart will discuss "Some Short Cut Statistical Methods."

D. F. Yeaton

WACO . . . Officers elected for the 1960-61 season, during the last meeting prior to the summer recess are chairman — Harry Cope, General Tire and Rubber; vice chairman — Don Barrett, Rocketdyne; secretary — Len Tempest, General Tire and Rubber Co., and treasurer — Sam Triplett, General Tire and Rubber Co.

The first meeting of the new season will be the annual joint meeting with the Dallas-Fort worth section, which was held last year in Waco. This 90-mile trek is always a pleasant innovation. C. F. Lewis, Cook Heating Co., Houston, Tex., will speak on "Statistically Designed Experiments." This meeting will begin at 7:30 p.m., October 17.

Donald H. Barrett

WASHINGTON, D.C. . . . The Washington, D.C., section has been active in the past few weeks compiling material and obtaining lecturers for our fall training session to be conducted at George Washington University. Our basic topics are analysis of variance techniques and operations research. Operation research will be conducted with respect to its methodology and philosophy. We will endeavor to make lectures as complete as possible in the time allowed, and with as little advanced mathematics as possible. The dates will be announced later.

A project headed by George Minton of the Bureau of Census will be attempted to standardize professional practice in industry and in government.

Eugene Tucker

WESTERN MASSACHUSETTS . . . On Wednesday evening, Oct. 5, at the Hotel Shelton, Springfield, Mass., the section will be honored by the presence of Ralph E. Wareham, the first ASQC executive secretary (1946-48) and the second ASQC president (1948-50).

This particular meeting has been designated Wico Electric Co., night and Allan Brownlee, vice president of Wico Electric Co., will introduce the main speaker, Mr. Wareham, whose topic will be "Practical Management of Quality Control."

Mr. Wareham is a member of Ralph E. Wareham and Associates, Consulting Engineers. In addition to positions previously mentioned, he was prime contractor, Army Ordnance QC Schools from 1950-55, and was on the industrial engineering faculty of Columbia University from 1947-57. Currently he is a consultant to many leading industrial plants.

On Nov. 8, A. P. Stergion, QC manager, Corning Glass Works, Corning N.Y., will be the main speaker. His subject will be, "A Practical Application of Statistical QC." Additional information covering this meeting will appear in the November issue of *Industrial Quality Control.*

Alan J. Donnelly

WICHITA . . . Attention has been focused on program planning to provide Wichita with outstanding speakers for the 1960-61 year. We are looking forward to a very interesting season.

The 15th Midwest Planning Committee has completed plans for the two day meeting at Wichita on Oct. 14-15. We have an outstanding program and we are looking forward to seeing many of you here.

Howard K. Mitchell

WORCESTER . . . The section will be host to the 14th New England QC Conference at the Hotel Bancroft, Worcester, Mass., Oct. 19-21.

Topics are "Total QC for Small Operations," "Management and Statistical QC," and "Quality Assurance and Reliability."

A unique feature is the industrial instrumentation clinic to be conducted by Federal Products Co., pertaining to mechanical measurements, and another conducted by General Radio for electrical measurements.

An interesting Ladies' program and four varied plant tours have been arranged.

Daniel J. Burda

Significant Differences

. . . Allentown-Bethlehem — **Ken Stephens,** our immediate past section chairman, has been moved up to department chief of QC engineering at the Allentown plant, succeeding **Bob Schin,** 1961 ASQC Convention program chairman, who has been moved up to assistant superintendent, Semi Conductor section, at Western's

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SECTION CALENDAR (OCTOBER 1 TO NOVEMBER 10)

SECTION	DATE	PLACE	TIME	SUBJECT	SPEAKER
Allentown-Bethlehem	Oct. 12	Hotel Traylor, Allentown, Pa.	8:00 p.m.	Some Observations on Acceptance Sampling	H. F. Dodge, Bell Telephone Laboratories (ret.)
	Nov. 9	Bethlehem Steel Co., Bethlehem, Pa.	2:00 p.m.	Plant tour	.....
Battle Creek-Kalamazoo	Oct. 20	Schulers Inn, Marshall, Mich.	7:00	Management Night, Management Needs Quality Control—Why?	Sydney M. S. Dunn, A. T. Kearney & Co.
Birmingham	Oct. 13-14	University of Alabama, Tuscaloosa, Ala.	9:00 a.m.	Annual QC Conference	Various
Boston	Oct. 20	MIT Faculty Club	8:00 p.m.	The QC Function as Related to the Organization Chart	Joseph D. Fernbach, IBM, Owego, N.Y.
	Oct. 19-21	Hotel Bancroft, Worcester, Mass.	8:30 a.m.	14th New England QC Conference	Various
	Nov. 10	MIT Faculty Club	8:00 p.m.	Controlling Quality Costs	J. Y. McClure, Convair Division, General Dynamics Corp.
Merrimac Valley Sub-section	Oct. 6	Yankee Doodle Restaurant, Lawrence, Mass.	8:00 p.m.	Problems in the Vendor-Vendee Relationship	Jeremiah Murphy, Office of Inspection of Naval Material
	Nov. 3	Yankee Doodle Restaurant, Lawrence, Mass.	8:00	Malfunction Reporting	Richard Jacobs, Sylvania Electric
Cincinnati	Nov. 19	Engineering Society Bldg.	8:00	Fundamentals of QC With Case Histories	M. L. Snow, Jr., Westinghouse Corp., Pittsburgh, Pa.
Cleveland	Oct. 7	Cleveland Engineering Scientific Center	7:45	Enduring Values	Jack Youden, National Bureau of Standards, Washington, D.C.
	Oct. 22	Republic Steel Research Center	7:00	Plant tour	.....
Columbus, Ohio	Oct. 19	Mead Paper Co., Chillicothe, Ohio	7:45	Plant tour	.....
Dallas-Fort Worth	Oct. 20	Arlington State College	8:00	To be announced	C. F. Lewis, Cook Heat Treating Co., Houston, Texas
Delaware	Oct. 6	Lord de la Warr Hotel	7:00	Probability	Hillman Harris
Evansville-Owensboro	Oct. 18	Evansville	6:30	Practical Applications of Statistical QC Techniques	J. E. Anderson, Iglehart Bros., Jello Division of General Foods, Inc.
Greater Detroit	Oct. 3	To be announced	...	International Night with Windsor, Canada ASQC section, with movie "Industrial Progress in Japan"	Howard Sprengel, Detroit Ordnance District
Harrisburg	Oct. 5	Castigilia's Restaurant, Harrisburg, Pa.	6:30	Frequency Distribution Analysis Sheet	Ervin F. Taylor, Martin Co., Baltimore, Md.
	Nov. 2	Elk's Club	6:30	Reliability	M. Tall, RCA, Moorestown, N.Y.
Hartford	Oct. 11	Nutmegger House	8:00	An Introduction to QC for the Ladies	C. W. Carter
Kansas City, Mo.	Oct. 20	To be announced	7:00	To be announced	.....
Lima	Oct. 11	Ford Motor Co., Lima, Ohio	7:00	Management Night	L. Polke, Sheffield Corp.
	Nov. 8	Standard Oil Co., Lima, Ohio	8:00	Sohio Inspectors Apply Statistical Methods	R. Decker, Standard Oil Company of Ohio
Los Angeles	Oct. 25	Institute of Aeronautical Science, 7660 Beverly Blvd., Los Angeles, California	7:00	To be announced	Lockheed Aircraft Quality Panel
Mid Hudson	Oct. 4	DuPont Fabric Factory, Newburg, N.Y.	7:00	Plant tour and short business meeting	.....
Minnesota	Oct. 11	Holiday Inn, St. Louis Park	6:30	Significant Tests and the Dollar Sign	Fred C. Laone, Statistical Laboratories, Case Institute, Cleveland, Ohio
Montreal	Oct. 22	Ecole Polytechnique, Montreal, Canada	9:00 a.m.	All Day Forum	Speakers on the theme "The Control of Quality"
Muncie	Oct. 20	Fisher Body Plant, GMC, Marion, Ind.	6:30 p.m.	Plant tour	.....
Muskegon	Oct. 13	Bill Sterns	6:30	Question the Question	.....
	Nov. 10	Drelles	6:30	.....	.....
Northeast Tennessee	Oct. 11	Bristol, Tenn.	6:00	Developing Industry Standards by Statistical Methods	H. W. Allen, American Iron & Steel Institute, New York, N.Y.
Parkersburg	Oct. 12	.....	.....	Resampling in a Chemical Process	E. J. Delate, E. I. DuPont Co.
Pensacola-Mobile	Oct. 13	Pensacola	7:00	QC Training of Engineers	Paul W. Hill, Texas Instrument Co.
Phoenix	Oct. 19	Ramada Inn	6:30	Video Sonic Instruction	Les Gideon, Hughes Aircraft Co., Los Angeles, Calif.
Pittsburgh	Oct. 25	St. Joseph Lead, Monaca, Pa.	...	Field Trip	To be announced
Pittsfield	Oct. 19	Stanley Club	8:00	Response Motivation	Ralph Burt
Portland	Oct. 4	Public Service Bldg.	7:30	The Many Opportunities for QC People in the Portland Area	Henry T. Blood, Omark Industries, Inc.
Rhode Island	Oct. 19-21	Hotel Bancroft, Worcester, Mass.	8:30 a.m.	14th New England QC Conference	Various
Rochester	Oct. 18	Chamber of Commerce Bldg.	6:15 p.m.	Dinner meeting	.....
St. Charles	Oct. 18	Tally Ho, North Ave., West Chicago, Ind.	5:30 p.m.	Management & Quality Control	Ernest H. Weinwurm, DePaul University
St. Louis	Oct. 21	Golden Fried Chicken Loaf Rest'nt	8:00	QC In the Stock Market	Mystery Guest
St. Petersburg-Tampa	Oct. 10	St. Petersburg	7:30	A New Approach to Quality and Reliability Engineering	J. D. Chamberlin, Electro Mechanical Research, Sarasota, Florida
San Diego	Oct. 17	Sands Hotel, Clairmont Mesa Blvd., Highway 395	7:00 p.m.	Philosophy and Goals of ASQC	J. Y. McClure, ASQC National President
South Texas	Oct. 19	Ben Milam Hotel, Houston, Tex.	7:00	A Discussion of Some Non-Parametric Tests for Significance	Charles F. Lewis, Cook Heat Treating Co.
State University of Iowa	Oct. 12	American Legion, Moline, Ill.	8:00	Machine Capability Studies, Joint Meeting with ASTE	To be announced
Toledo	Oct. 6	Dana Corp.	7:00	Plant tour	.....
University of Western Ontario	Oct. 19	Stratford	6:30	Management Night	Jack Symmons, Dominion Rubber Co.
	Nov. 5	Hamilton		Hamilton Forum	.....
	Nov. 9	London	6:30	Cost vs. Quality	Harry McCormack, Controls Co., Can., Ltd.
Utica	Oct. 20	Hotel Hamilton	6:15	Some Short Cut Statistical Methods	Gordon H. Beckhart
Waco	Oct. 17	Dallas, Texas	7:30	Statistically Designed Experiments	C. F. Lewis, Cook Heating Co., Houston, Texas
Western Massachusetts	Oct. 5	Shelton Hotel, Springfield, Mass.	6:30	Practical Management of Quality Control	Ralph E. Wareham, Ralph E. Wareham and Associates, Consulting Engineers
Wichita	Nov. 1	Shirkmere Hotel Dining Room	6:30	Who Controls Quality and How	W. R. Purcell, Raytheon Manufacturing Co.
Worcester	Oct. 19-21	Hotel Bancroft, Worcester, Mass.	8:30 a.m.	14th New England QC Conference	Various

Kansas City plant. Also, **John Tepper** will be the new department chief of QC engineering at the Kansas City location.

. . . Boston — **Bernard A. Goldsmith** of Northeastern University has received his certification as Professional Engineer from the State of Massachusetts.

Warren Grosjean and **Ted Brownrigg** have moved to Minneapolis-Honeywell, Datamatic Division.

. . . Cincinnati — **Bill Barker** has been appointed chairman of the ASQC membership committee.

Vernon Eklund and **Ted Cornish** will be chairman and registrar, respectively, for the annual January Conference.

. . . Cleveland — Congratulations are due **Harry Wadsworth** and **Don Leckie.** Harry has received his Ph.D from Western Reserve University and Don has received his doctorate from Case Institute of Technology. Unfortunately for the Cleveland section, Mr. Wadsworth has accepted a position with Georgia Tech and will be leaving shortly to take over his new job. Our best wishes go with him.

. . . Cumberland — **David A. Powers** has been named development manager at the Amcelle plant of Celanese Fibers Co. Previously he was QC superintendent.

Alfred H. Jaehn has moved from QC engineer in the Cellulose Compounds section to senior QC engineer in the extrusion section at Amcelle.

. . . Dallas-Fort Worth — **Paul Hill,** manager of one of the Quality Assurance sections in the Semiconductor Components Division of Texas Instruments, has taken a position with Fairchild Semiconductor in Mountain View, Calif. We wish Paul the best of luck and thank him for the many fine jobs he has done, both locally and nationally.

Fellow **J. L. Coburn,** Dallas-Fort Worth section's founding chairman, also its second chairman, has accepted a position with Lockheed Aircraft Corp., Missiles and Space Division, Sunnyvale, Calif. Jim has been most active both in the local and the National ASQC. He is one of the Society's most prominent speakers. Our loss is California's gain. We know that he will do well in his new position as manager of requirements and controls, and we wish him the best of luck. He leaves a big blank space in the Dallas-Fort Worth section.

. . . Greater Detroit — **Stephen J. Adams** has been appointed divisional QC manager of Wolverine Tube, Division of Calumet and Hecla, Inc.

Jack Comiskey has been appointed QC engineer at Hoover Ball and Bearing Co., Ann Arbor, Mich.

W. Blake Tripp has been appointed plant manager, United Welders Inc., Bay City, Mich. In his new position, he will be responsible for engineering and manufacturing the special-purpose welding and assembly machines made by the company. He was formerly chief industrial engineer for special projects with Avco, with whom he worked for nine years.

. . . Harrisburg — **M. Tall,** RCA, Moorestown, N.J., will speak on "Reliability," at the meeting Nov. 2, in Lancaster Pa.

. . . Hartford — **Richard Bergern** is now QC engineer with Underwood Corp.

Chuck Dennis has joined Cramer Controls, Centerbrook, Conn., as a QC engineer.

Ed Tereba is now a QC engineer with the Stanley Works of New Britain.

. . . Kansas City — **Vivian L. Crawford** is now statistical QC supervisor, Bendix, Kansas City Division; **John L. Welch** to North American Autonetics; **Clark W. Hargis,** North American Rocketdyne; **Boyd C. Nusbaum,** North American Autonetics; **James Crichton,** U.S. Time; **John Valentik,** Westinghouse; **Frank Csuri,** North American Rocketdyne; **Delbert Cull,** Mack Truck, and **Jay R. Rumberger,** Bendix Corp.

. . . Lima — **Charles H. Miller,** formerly manufacturing superintendent, Sylvania Electric, Ottawa, Ohio, is the new manager of Sylvania Electric.

Westinghouse Electric, Lima, recently employed **George Cramer** from Bryant Electric, Bridgeport, Conn., as receiving inspection superintendent.

Don Greb, assistant QC manager, Atomic Power Division, is now QC manager at Westinghouse Electric, Lima, Ohio.

At Ford Motor Co., Lima, Ohio — **William Miller,** analyst, promoted from laboratory technician; **Ralph Neiswander,** inspection foreman, promoted from analyst; **James Micheli,** receiving inspection foreman, from vendor liaison representative; **Donald Roethlisberger,** general foreman, from analyst, and **Nolan Jones,** from clerk to QC illustrator.

. . . Los Angeles — **Carlos Sharpes,** quality assurance executive, has been appointed director of quality assurance at National Astro Laboratories, a quality assurance and standards laboratory at Pasadena, Calif.

. . . Metropolitan — **Benjamin K. Sachs,** formerly manager of QC and planning, Ketay Department, Norden Division, United Aircraft Corp., is now president of a new firm, the Paratron Corp., a new organization with officers in Carle Place, N.Y., that specializes in independent research to determine the reliability of electronic and electromechanical components in commercial and government equipment.

Paul C. Clifford, who attended the EOQC Conference in London Sept. 1-3, traveled to Spain Sept. 15 to serve as consultant to the Spanish Government through Nov. 15. His address is U.S. Operations Mission, U.S. Embassy, Madrid, Spain. Attention: Industry Officer.

. . . Mid Hudson — **Saul Twicken,** staff engineer to the quality manager, has been reassigned as project engineer in the quality engineering department, IBM Corp., Poughkeepsie, N.Y.

. . . Milwaukee — **George I. Craycraft,** immediate past chairman and junior director, announced at our last executive committee meeting that he and the family are pulling stakes in Milwaukee and resettling in Minneapolis, Minn. Mr. Craycraft has resigned from Dynex, Inc., and has accepted a position as quality director with Minneapolis-Moline. We of the Milwaukee section wish George good luck in his new position and we know our loss of his able leadership will be to the gain of the Minnesota section.

The Milwaukee section was well represented at the 1960 ASQC Convention and Exhibition in San Francisco, Calif. Attending were **Les Eichelberger,** ASQC vice president; **William P. Youngclaus, Jr.,** ASQC administrative secretary; **George R. Foster,** managing editor, IQC; **Jean Truettner,** ASQC office manager; **Irv. Schoeninger,** ASQC Executive director, and **George E. Craycraft,** Milwaukee section chairman.

Upon completion of the final business of this convention, two of the above members, Mr. Schoeninger and Mr. Foster and family, extended their California stay by taking their vacations. Ironically, though neither George nor Irv knew of each other's plans, their paths crossed at Disney Land—"it's a small world."

Mr. Eichelberger and his wife explored the state of Oregon, and Mr. Youngclaus and Jean Truettner attended the Mid Pacific QC Conference in Honolulu, Hawaii.

. . . Montreal — **Gaston Fournier** has been named director of research of Acton Rubber. He was formerly chief chemical engineer of the company at Actonvale, Quebec.

Don Parks of the Steel Company of Canada has replaced **Don Schroder,** Imperial Tobacco Co., as a director of the Montreal section.

R. Vance Ward of Canadian Industries, Ltd., has been

transferred to Toronto, and as a past chairman, will be missed by the section.

Peter Wade, formerly of the Aluminum Co., in Kingston, Ontario, is now with Price, Waterhouse Co., in Montreal.

. . . Northeast Tennessee — **Bob Keeney** of Raytheon Co., has been appointed quality assurance section head at the Bristol plant.

Marshall Carrol has left Raytheon, Bristol, to go into business for himself.

Ed Maryanski of Monroe Calculating Co., has been promoted to QC manager.

George Koch of Monroe has been promoted to chief inspector.

. . . Pensacola-Mobile — Colonel **H. W. Randall,** previously chief, quality control office, headquarters, Mobile Air Materials Area, has been transferred to the Central Contract Management Region, AMC, as director of quality control.

Eldon Johnson, Glen Johnstone, John Hensley, Harrell Russell and **Gene Blakie,** have been transferred from the QC office, Headquarters Air Material Area, to positions in the Directorate of QC, Central Contract Management Region, Dayton, Ohio. Mr. Johnson will be deputy chief of the Directorate.

Milton Harris has been transferred from the QC office to a position in the Engineering Division, Headquarters, Mobile Air Materiel Area.

L. J. Trahan of International Paper and section treasurer, has been promoted to technical director.

. . . Pittsfield — **John J. Landers,** senior member who has been QC manager in the Ordnance Department of General Electric Co., has joined Northronics, Inc., in Norwood, Massachusetts.

. . . Portland — **Kenneth King** of Textronix, Inc., our new program chairman, has recently accepted additional responsibilities as management development instructor for his company.

Ray Vanderzanden of Sawyers, Inc., has announced plans for another QC class for the winter term at the Portland State Extension Center.

. . . Rochester — **Al Davis,** Rochester Institute of Technology, has been made vice president of that college.

. . . Sacramento — This section won the Western Conference attendance award presented each year for attendance at the National Convention. The 90.48 percent attendance certainly looked good when the tabulations were completed! The beautiful plaque was proudly displayed at the September meeting.

. . . St. Charles — **L. B. Crawford,** QC director, Admiral Corp., and past vice chairman of the St. Charles section, has recently returned from a five week stay in Milan, Italy, where Admiral has a Television and Appliance production facility. Mr. Crawford worked with Italian vendors in setting up quality standards for parts to be used in Admiral products.

Chris Wyatt, our auditing and examining chairman, is busy checking the qualifications of members to see who is eligible to advance to a higher grade.

. . . San Diego — **H. L. Anderson,** formerly chief of inspection at the Convair Palmdale, Calif., facility, has been appointed chief of quality assurance-electronics, at Convair, San Diego, Calif.

. . . San Francisco — Officers for the 1960-61 season are chairman — **Lyle Connell,** Westinghouse Electric Corp.; vice chairman — **Gerald J. Desmond,** Gerber Products Co.; secretary — **Arthur J. Brown,** Friden, Inc., and treasurer — **Ronald Berkhimer,** Fibreboard Paper Products.

. . . South Texas — **Paul Tidwell** will not be with us this year as he will be adding to his QC knowledge at the University of Wisconsin.

. . . Southern Connecticut — **Dave Albert,** outgoing section chairman, has been promoted to QC manager of Norma-Hoffman Bearings Corp. **Howard Levenson,** also a past section chairman, has formed his own company, Q-Center, Inc., in Norwalk, specializing in QC services.

. . . State University of Iowa — New officers for the 1960-61 season are chairman — **James F. Logsdon,** Sheaffer Pen; vice chairman — **Everett E. Lawson,** Philco-Dexter, and secretary-treasurer — **M. F. Wilson.**

Robert Cannon, Eagle Signal, has taken over the important function of program chairman for this year.

. . . Waco — The section welcomes **George Hovan,** who has recently joined the Air Force QC staff at Air Force Plant 66. Mr. Hovan was formerly with Atomics International, Canoga Park, Calif.

. . . Washington, D.C. — During the recent month, **Jack Peunisson** was elected treasurer of the Electronic Division and **"Mac" Magruder** was elected chairman of the Administration Division. Good luck "Mac" and "Jack."

. . . Wichita — **Max P. Eaton,** formerly QC chief, Beech Aircraft Corp., has been promoted to QC manager succeeding **Paul E. Allen,** who has transferred to the Marketing Division at Beech Aircraft Corp.

. . . Worcester — The section's executive committee held a meeting and a cook-out Aug. 9, at the camp of **Axel U. Sternlof,** ASQC past section chairman. Mr. Sternlof served as host and chef.

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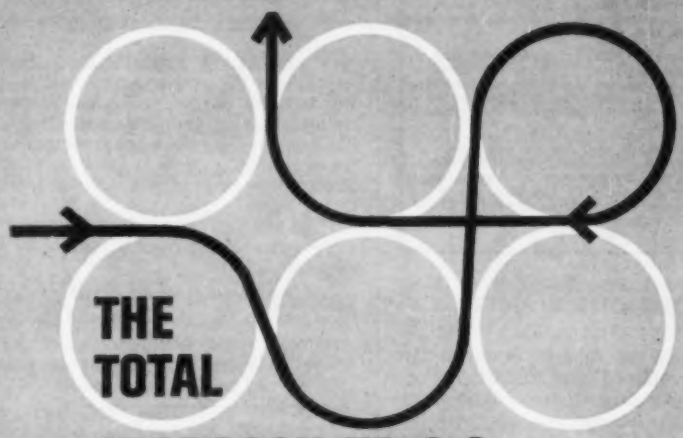

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. . . **26-30**—Instrument Society of America Fall Instrument-Automation Conference and Exhibit and 15th Annual Meeting, New York Coliseum, New York, N. Y., contact Director of Technical and Educational Services, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

. . . **27-30**—Exposition and Convention sponsored by the Association of Iron and Steel Engineers at the Cleveland Auditorium, Cleveland, Ohio, contact Association of Iron & Steel Engineers, 1010 Empire Building, Pittsburgh 22, Pa.

. . . **27-29**—Eleventh Annual Testing Conference sponsored by the Technical Association of the Pulp and Paper Industry (TAPPI), Pantlind Hotel, Grand Rapids, Mich. A symposium will be conducted on the testing of "Water—the Most Important Non-Fibrous Raw Material." Contact TAPPI, 11th Testing Conference, Pantlind Hotel, Grand Rapids, Mich.

. . . **30-Oct. 1—Evolutionary Operations (EVOP) Course sponsored jointly by the ASQC Chemical Division and the ASQC South Texas section at the Ben Milam Hotel Houston, Tex. Instructors will be J. Stuart Hunter, University of Wisconsin, and Truman L. Koehler, American Cyanamid Co. Course fee is $100.00, and registration will be limited to 50 persons. Contact Jim C. Deland, Shell Oil Co., P. O. Box 2527, Houston 1, Tex.**

OCTOBER

. . . **4-7**—Tenth Annual Instrument Symposium and Research Equipment Exhibit, National Institutes of Health, Bethesda, Md., sponsored by the Washington sections of the American Association of Clinical Chemists, American Chemical Society, Instrument Society of America, Society of American Bacteriologists, Society for Experimental Biology and Medicine; primary topics include fluorescence, infra-red, activation analysis, ultra-centrifuge, microscopy and electrodes. Contact Herman C. Ellinghausen, Agricultural Research Center, U. S. Department of Agriculture, Beltsville, Md.

. . . **5**—Plastics vs. Corrosion, a Regional Technical Conference sponsored by the Golden Gate section of the Society of Plastics Engineers, contact Douglas H. Wright, chairman, registration committee, c/o Hewlett-Packard Corp., 1701 Page Mill Road, Palo Alto, Calif.

. . . **6-8—Fourth ASQC Workshop-Seminar, Statler Hilton Hotel, St. Louis, Mo., Paul C. Clifford, director, professor at Montclair State College. Address inquiries to: Fourth ASQC Workshop-Seminar, ASQC, 161 W. Wisconsin Ave., Milw. 3, Wis.**

. . . **8—Rocky Mountain Empire Quality Control Clinic, Albany Hotel, Denver, Colorado, sponsored by the Denver ASQC section, contact Duncan R. Ackley, general chairman, Rocky Flats Area Office (USAEC), P. O. Box 2611, Denver, Colorado.**

. . . **10-12**—16th Annual National Electronics Conference, Sherman Hotel, Chicago, Ill., sponsored by the American Institute of Electrical Engineers, Illinois Institute of Technology, Institute of Radio Engineers, Northwestern and Illinois Universities. Participants incude Iowa State, Notre Dame and Purdue Universities, Michigan State, Wayne State, Michigan and Wisconsin Universities, Electronic Industries Association and Society of Motion Picture and Television Engineers. Contact NEC, 228 N. LaSalle St., Chicago 1, Ill.

. . . **10-13**—Tenth Corrugated Containers Conference, Royal York Hotel, Toronto, Canada, sponsored jointly by the Technical Association of the Pulp and Paper Industry (TAPPI), New York, and the technical section of the Canadian Pulp and Paper Association (CPPA), Montreal. This will be the first such conference to be held in Canada. Contact H. O. Teeple, TAPPI, 360 Lexington Ave., New York 17, N.Y.

. . . **10-15—Reliability Training Conference at the Lake Texhoma Lodge near Kingston, Okla., north of the Dallas-Fort Worth area, sponsored by the ASQC Electronics Division and the PGRQC of IRE, contact Art Roddey, registration chairman, Institute for Defense Analysis, The Pentagon, Washington 25, D. C.**

. . . **13-14—University of Alabama Quality Control Conference sponsored by the Birmingham ASQC section at the University of Alabama, Tuscaloosa, Ala., contact E. J. Finnell, director, Engineering Extension Services, University, Ala.**

. . . **14—Engineering for Reliability Conference at New York University, Washington Square, New York, N.Y., sponsored by the ASQC Electronics Division and the IRE Professional Group on Reliability and Quality Control. Advance registrations, $3.00, or orders for single copies of the Conference proceedings, $2.00, may be sent to J. C. Duryea, Sperry Gyroscope Co., Great Neck, N.Y.**

. . . **14-15—Fifteenth Midwest Quality Control Conference, Wichita, Kans., contact Ralph D. Humphries, Cessna Aircraft, Wichita, Kans.**

. . . **14-15**—Symposium sponsored by the Society of Photographic Scientists and Engineers in Washington, D.C., on short access time, compact, simplified photographic processing equipment, contact Society of Photographic Scientists & Engineers, Box 1609, Main Post Office, Washington, D.C.

. . . **16-19**—15th Plastics-Paper Conference of the Technical Association of the Pulp and Paper Industry at the Hotel Syracuse, Syracuse, N.Y. Reservations for hotel accommodations may be made by writing direct to TAPPI 15th Plastics-Paper Conference, Hotel Syracuse, Syracuse, N.Y. For additional information, contact V. T. Stannett, general chairman, College of Forestry, Syracuse, N.Y.

. . . **19**—First Annual Meeting of the Fluid Power Society at the Hotel Sherman, Chicago, Ill., contact FPS, 5595 N. Hollywood Ave., Milwaukee 17, Wis.

. . . **19-21—Fourteenth New England Quality Control Conference, Hotel Bancroft, Worcester, Mass., contact Francis B. Olson, Norton Company, New Bond St., Worcester, Mass.**

. . . **19-26**—INTERKAMA, 2nd International Congress and Exhibition for Instrumentation and Automation, Duesseldorf, Germany. For information, admission tickets, and room reservations, contact the German American Chamber of Commerce, 666 Fifth Avenue, New York 19, N. Y.

. . . **20-22**—Seventh International Meeting, Institute of Management Sciences, for administrators and scientists in the field of management, Hotel Roosevelt, New York, N. Y. Registration fees—members $15, non-members $20, students $5. Contact James Townsend, 30 East 42nd St., New York 17, N. Y.

. . . **22—Fourth Annual All Day Forum sponsored by the Montreal ASQC section at the Ecole Polytechnique, Montreal, Quebec, contact S. L. Humphries, Aviation Electric Co., Ltd., P.O. Box 6102, Montreal, Quebec, Canada.**

. . . **24-28**—15th Engineering Conference, Robert Meyer Hotel, Jacksonville, Fla., sponsored by the Technical Association of the Pulp and Paper Industry (TAPPI), contact Eleanor Ney Wark, Technical Association of the Pulp

ASQC-IRE Engineering for Reliability Conference

An "Engineering for Reliability" Conference will be held Oct. 14, at New York University, Washington Square, New York, N.Y.

It will be sponsored by the ASQC Electronics Division and the IRE Professional Group on Reliability and Quality Control, Metropolitan New York Chapter.

During morning, afternoon, and evening sessions, the Conference will study some of the engineering principles and techniques now available for the measurement and control of reliability in electronic equipment.

To provide ample time for an interchange of ideas and experiences, the Conference will limit its attention to six key reliability activities, with each being introduced by an eminent authority as follows: part application—W. T. Sumerlin, Philco Corp.; mechanical factors—speaker to be announced; the human element—F. A. Brooks, Jr., Dunlap and Associates; design reviews—E. F. Dertinger, Raytheon; reliability testing—R. G. Fitzgibbons, Raytheon, and failure analysis—Richard Doyen, AC Spark Plug.

Advance registrations, $3.00, or orders for single copies of the Conference proceedings, $2.00, may be sent to J. C. Duryea, Sperry Gyroscope Co., Great Neck, N. Y.

and Paper Industry, 360 Lexington Ave., New York 17, N. Y.

. . . **31-Nov. 2**—13th Annual Conference on Electrical Techniques in Medicine and Biology, Sheraton Park Hotel, Washington, D.C., sponsored by ISA, AIEE, IRE, contact Dr. R. L. Bowman, National Heart Institute, Bethesda 14, Maryland.

. . . **31-Nov. 5**—One-week course in packaging management, Hotel Astor, New York City, sponsored by the American Management Association. Contact American Management Association, 1515 Broadway, Times Square, New York 36, New York.

NOVEMBER

. . . **3-4—Fourth Technical Conference, Chicago, Ill., sponsored by the ASQC Chemical Division, contact Karl J. Bauer, Abbott Laboratories, North Chicago, Ill.**

. . . **5—Fourth Annual QC Forum, McMaster University, Hamilton, Ont., jointly sponsored by the Hamilton and University of Western Ontario ASQC sections. Contact Carmen C. Cantion, Canadian Westinghouse Ltd., Hamilton, Ont.**

. . . 7—Plastics and Automatic Control SPE Regional Technical Conference at the King Edward Sheraton Hotel, Toronto, Ont., Canada, sponsored by the SPE Ontario section. Advance registration fee, which includes preprint book and luncheon, is $7.50 for SPE members and $9.00 for non-members. Contact John D. Glen, chairman, registration committee, Canadian Industries, Ltd., 1303 Yonge St., Toronto, Ont., Canada.

. . . **11-12—Eighth Annual Aircraft and Missiles Division Conference and Middle Atlantic Conference, Lord Baltimore Hotel, Baltimore, Md., contact Stanley Kalin, Dept. 251, Bendix Radio Corp., Baltimore 4, Md.**

. . . **15-16**—Symposium on Engineering Applications of Probability and Random Function Theory, Lafayette, Ind., sponsored by Purdue University. The symposium will stress applications of probability and random function theory Contact J. L. Bogdanoff or F. Kozin, Symposium co-chairmen, Division of Engineering Science, Purdue University, Lafayette, Ind.

. . . **18—All Day Conference on Quality Control and Reliability, sponsored by the Cleveland ASQC section, at the Pick-Carter Hotel, Cleveland, Ohio, contact L. S. Nelson, General Electric Co., Nela Park, East Cleveland 12, Ohio.**

. . . **19—Annual All Day Conference sponsored by the ASQC Northeastern Indiana section at the Chamber of Commerce, Fort Wayne, Ind., contact Howard F. Spicer, 712 Home Ave., Fort Wayne, Ind.**

. . . **26—Windsor All Day Quality Control Forum at the Cleary Auditorium and Memorial Convention Hall, Windsor, Ont., Canada, sponsored by the Windsor, Ont., ASQC section. Contact Kenneth Crew, 464 Mathew Brady, Riverside, Ont., Canada.**

DECEMBER

. . . **13-15**—Tenth Annual Eastern Joint Computer Conference (EJCC), Hotel New Yorker and Manhattan Center, sponsored by the National Joint Computer Committee, which consists of representatives of the Institute of Radio Engineers, the American Institute of Electrical Engineers, and the Association for Computing Machinery. Contact P.O. Box 2580, Grand Central Station, N. Y. 17, N.Y.

. . . **14-16**—Second Annual Seminar on Color Control for the Graphic Industries at the Rochester Institute of Technology, Rochester, N.Y. Topics include fundamentals of color, color specification, illumination, color vision, inspection and process control. Contact Harold Kentner, director of Extended Services, Rochester Institute of Technology, Rochester 8, N.Y.

JANUARY

. . . **9-11—Seventh National Symposium on Reliability and QC, Bellevue-Stratford Hotel, Philadelphia, Pa., sponsored by the IRE, AIEE, EIA, and ASQC. Contact R. L. Schwerin, vice chairman, publicity committee, ACF Electronics Div., ACF Industries, Inc., 11 Park Place, Paramus, N.J.**

. . . **11-12—Two Day National Seminar on Quality Control, St. Louis, Mo., co-sponsored by ASQC and ASTME, contact ASTME, 10700 Puritan, Detroit 38, Mich.**

. . . **16-19**—ISA Winter Instrument-Automation Conference & Exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis, Mo., contact William H. Kushnick, executive director, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

FEBRUARY

. . . **18-20—Tenth Annual Textile Division Conference, Clemson House, Clemson, S. C., contact R. G. Mitchell, International Latex Corp., Dover, Del.**

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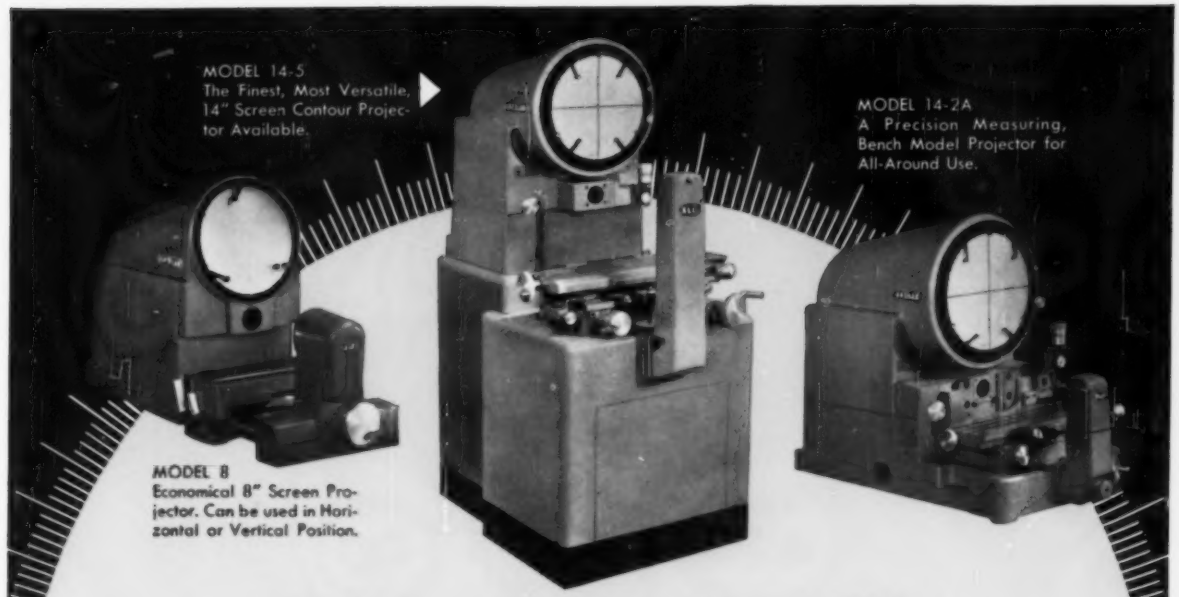

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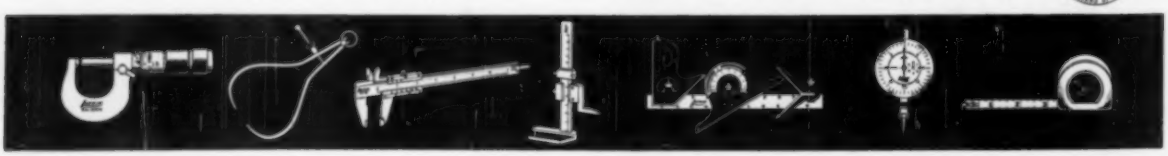
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